FCC 94-261

# Before the
# FEDERAL COMMUNICATIONS COMMISSION
# Washington, D.C. 20554

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| In the Matter of | ) | |
| | ) | |
| Amendment of the Commission's Rules | ) | CC Docket No. 92-166 |
| to Establish Rules and Policies Pertaining | ) | |
| to a Mobile Satellite Service in the | ) | |
| 1610-1626.5/2483.5-2500 MHz | ) | |
| Frequency Bands | ) | |

## REPORT AND ORDER

Adopted: October 13, 1994 Released: October 14, 1994

By the Commission:

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Appendix A
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## I. INTRODUCTION

1. By this Report and Order, the Commission takes the next step in the process of licensing the world's first commercial low-Earth orbit (LEO) satellites capable of providing both voice and data mobile satellite services (MSS) on a global basis. The satellites are to operate in the 1610-1626.5/2483.5-2500 MHz bands that were recently allocated both internationally and domestically to MSS.[1] This new mobile satellite service -- the "MSS Above 1 GHz" or "Big LEO" satellite service -- has the potential to provide not only a variety of new services to users in the United States, but to provide integrated communication services to all parts of the world, including those that are now grossly underserved. In a Notice of Proposed Rulemaking (Notice), adopted in January 1994,[2] the Commission proposed rules and policies to govern the service. Thirty-three parties filed comments in response to the Notice and 18 parties filed reply comments.[3] Since the pleading cycle closed, four of the applicants filed a Joint Proposal and Supplemental Comments (Joint Proposal).[4] A fifth applicant sent a letter to the Chairman (FCC) on September 14, 1994 regarding the Joint Proposal.[5] In this Report and Order, we adopt many of the proposals in the Notice, adopt others with modifications, and defer action on several issues where a decision is premature. We also adopt many, but not all, of the terms of the Joint Proposal. We believe our decision will promote participation by the greatest number of applicants in an expeditious time frame.[6] It will create a new industry providing enormous economic benefit to the United States, and any other country that chooses to participate in the service.

2. All six applicants who filed applications by the cut-off date, as detailed below, will be provided with an opportunity to file amended applications that conform with the rules adopted today. Given the importance of proceeding quickly with licensing systems in this revolutionary service, amended applications must be filed by November 16, 1994 in order to receive continued consideration. As is our usual practice in the satellite area, each applicant must request construction, launch and operating authority to retain its status in this processing group. All

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[1] International Telecommunication Union, Final Acts of the World Administrative Radio Conference (WARC-92), Malaga-Torremolinos (1992); Report and Order, ET Docket No. 92-28, 9 FCC Rcd 536 (1994) (Allocation Order).

[2] Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands, 9 FCC 2d 1094 (1994).

[3] A list of commenters is attached as Appendix A.

[4] See note 23, infra.

[5] See note 23, infra.

[6] See S.R. 103-309 (July 14, 1994).

amendments must be accompanied by the appropriate fee for applications for launch and operating authority for LEO satellite systems, if that fee has not yet been submitted. Applicants will be provided until January 31, 1996, at their option, in which to make a complete financial showing.[7]

3. As described in the Notice, the Big LEO service can offer an almost limitless number of services, including ubiquitous voice and data mobile services, position location services, search and rescue communications, disaster management communications, environmental monitoring, paging services, facsimile transmission services, cargo tracking, and industrial monitoring and control.[8] Domestically, this service will help meet the demand for a seamless, nationwide and eventually global communications system that is available to all and that can offer a wide range of voice and data telecommunication services. In addition to enhancing the competitive market for mobile telecommunication services in areas served by terrestrial mobile services, this new mobile satellite service will offer Americans in rural areas that are not otherwise linked to the communications infrastructure immediate access to a feature-rich communications network. Moreover, Big LEO systems can extend these benefits throughout the world, and can provide those countries that have not been able to develop a nationwide communication service an "instant" global and national telecommunication infrastructure.[9] This network can be used to provide both basic and emergency communications to their entire populations. Big LEO systems may prove to be a critical component in the development of the global information highway.

4. The Big LEO service also has the potential to stimulate significant economic growth both in the United States and abroad. A potential multi-billion dollar industry will be created, generating opportunities for economic growth in a variety of markets. First, the estimated costs to construct the applicants' space segments range from $97 million to over $2 billion each. The manufacturing costs for the ground segment, which include both user units and gateway stations, are expected to be hundreds of millions of dollars more. Thus, manufacturing these systems may lead to a substantial investment in the United States economy and create a significant number of high paying jobs in the areas of research and development, production, marketing and service administration. As the services become available, additional growth opportunities will be created. One of the applicants, for example, expects that by 2001 the demand for user transceivers will be 1.3 million in the United States and 4.7 million worldwide.[10] If so, this will create a major global industry whose function will be to provide users with mobile units and services. As demand grows and as markets develop, additional

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[7] See para. 40, infra.

[8] See paras. 196-202, infra, regarding the use of Big LEO systems for emergency communications.

[9] It is estimated that some of these services will cost as little as 22 cents per minute.

[10] Application of Motorola Satellite Communications, Inc. at 11.

employment opportunities will be created. Customer purchases of transceivers and user service charges will generate additional investment in the economies of the host countries. Finally, the enhanced communications services offered by this industry will, of themselves, create a broad secondary economic growth. Immediate access to an advanced global communications infrastructure can increase the efficiency of existing businesses and create new ones.

5. The United States has led the world in developing and implementing satellite technology. We expect many of the economic, cultural and other gains we have seen in the fixed-satellite industry to be reflected in the new mobile satellite industry. The Big LEO proposals before us represent an opportunity for the United States to continue its leadership role in promoting global development through enhanced communication infrastructures and services. We intend to license these systems as quickly as possible so that this opportunity is not lost.

## II. BACKGROUND

6. As described in the Notice,[11] this proceeding was initiated in late 1990, when Ellipsat Corporation (Ellipsat)[12] and Motorola Satellite Communications, Inc. (Motorola) filed applications to construct LEO satellite systems in the 1610-1626.5/2483.5-2500 MHz bands and the 1610-1626.5 MHz band, respectively.[13] At the time these applications were filed, there was no frequency allocation in these bands for MSS. The bands were allocated to, among other services, the radiodetermination satellite service (RDSS), which encompasses satellite radionavigation and radiolocation services.[14] The Motorola and Ellipsat systems were intended to provide voice and data MSS in addition to RDSS. Both applicants requested waivers of the

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[11] See Notice, note 2, supra, at paras. 5-9.

[12] Ellipsat is now doing business as Mobile Communications Holdings, Inc. Because it has participated throughout this proceeding as Ellipsat, we will continue to refer to it as Ellipsat in this Report and Order.

[13] Ellipsat proposed the 1.6 GHz band for Earth-to-space transmissions and the 2.4 GHz band for space-to-Earth transmissions. Motorola proposed to use the 1.6 GHz band for bidirectional transmissions. Motorola later modified its application to request the 1616-1626.5 MHz band only. See Minor Amendment filed by Motorola (Aug. 14, 1992).

[14] Portions of the bands are also allocated to the aeronautical radionavigation service (ARNS), the radioastronomy service, the terrestrial fixed-service and for use by industrial, scientific, and medical equipment. See paras. 98-162, infra, for a complete discussion of sharing between MSS and other allocated services.

U.S. Table of Frequency Allocations, 47 C.F.R. § 2.1, to permit non-conforming MSS operations in the bands.[15]

7. The Commission placed the Ellipsat and Motorola proposals on public notice and established a June 3, 1991 cut-off date for filing applications to be considered concurrently with them.[16] In response, Constellation Communications, Inc. (Constellation), Loral Cellular Systems Corp., now doing business as Loral Qualcomm Partnership (LQP), TRW, Inc. (TRW), and AMSC Subsidiary Corporation (AMSC) filed applications. Constellation, LQP, and TRW proposed to construct LEO satellite systems. AMSC proposed to add additional frequencies onto its authorized geostationary satellite-orbit (GSO) system.[17] The LEO applicants proposed two basic LEO system architectures. TRW, LQP, Ellipsat, and Constellation proposed a code division multiple access (CDMA) architecture. CDMA systems can share the same frequencies when operating under certain technical constraints.[18] Motorola proposed a time division multiple access/frequency division multiple access (TDMA/FDMA) architecture. TDMA/FDMA systems must operate on separate dedicated frequencies.[19] AMSC's proposed GSO system could use either CDMA or narrowband FDMA techniques.

8. The World Administrative Radio Conference (WARC-92), allocated frequencies for MSS in February 1992.[20] Specifically, the 1610-1626.5 MHz band was allocated on a co-primary basis with other radio services for MSS Earth-to-space operations and the 2483.5-2500

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[15] These waiver requests have become moot in light of the subsequent domestic and international MSS allocation in these bands. See note 1, supra.

[16] Public Notice, Report No. DS-1068, 6 FCC Rcd 2083 (1991).

[17] AMSC requested authority to modify its authorized upper L-band (1545-1559/1646.5-1660.5 MHz) MSS system to include the 1616.5-1626.5 MHz frequency bands.

[18] Spread spectrum CDMA is a digital transmission technique in which the signal occupies a bandwidth larger than that needed to contain the information being transmitted. Because the signal is spread over a wide bandwidth, the power is dispersed and interference potential is reduced. The spreading is accomplished by modulating the signal by a code that is independent of the information data. A synchronized code in the receiver is used to de-spread the signal and recover the information. The spreading and the variation in the code permit a number of users to operate on the same frequency simultaneously without causing harmful interference.

[19] TDMA is a transmission technique in which the same frequency band is used by both uplink and downlink transmissions in alternating time slots. FDMA provides multiple discrete channels with different center frequencies.

[20] See note 1, supra.

MHz band was allocated on a co-primary basis for space-to-Earth operations.[21] In addition, a secondary allocation was made for MSS space-to-Earth operations in the 1613.8-1626.5 MHz segment of the 1.6 GHz band. Shortly thereafter, the Commission proposed an identical domestic allocation and subsequently adopted that allocation in December 1993.[22]

9. The Commission conducted a negotiated rulemaking from January through April 1993 to assist it in developing technical rules for the MSS Above 1 GHz service. The Negotiated Rulemaking Committee's (the Committee's) work included technical matters relating to compatibility among the proposed MSS systems (inter-system sharing issues), compatibility between MSS and other services in the band or in adjacent bands (inter-service sharing issues), and the operations of MSS feeder links and intersatellite links. The Committee reached consensus on many issues, but did not reach a consensus regarding a technical method by which all proposed systems could be accommodated within the 1610-1626.5/2483.5-2500 MHz bands.[23]

10. In January 1994, the FCC adopted the Notice proposing, among other things, a LEO design requirement, a requirement that systems be capable of serving all areas of the world (except for the polar regions) for at least 75% of each day, a requirement that systems be capable of serving all areas of the United States at all times, and a requirement that applicants demonstrate sufficient current assets or irrevocably committed financing to meet construction and launch costs for the entire system. We also proposed a spectrum sharing plan that could accommodate up to five systems. We indicated that if mutual exclusivity could not be resolved, we would consider awarding licenses by auction, lottery or comparative hearing.[24]

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[21] "Primary" services have equal rights to operate in particular frequencies. Stations operating in primary services are protected against interference from stations of "secondary" services. Moreover, stations operating in a secondary service cannot claim protection from harmful interference from stations of a primary service. See 47 C.F.R. §§ 2.104(d) and 2.105(c).

[22] See note 1, supra.

[23] See Report of the MSS Above 1 GHz Negotiated Rulemaking Committee (Apr. 6, 1993). The Committee included two independent attachments discussing this issue in the Report. One was supported by AMSC, Celsat, Inc., Constellation, Ellipsat, LQP and TRW. The other was supported by Motorola. Since the end of the Negotiated Rulemaking, the LEO applicants have submitted several partial settlement proposals. See Joint Filed Comments, submitted by Motorola and LQP (Oct. 7, 1993); Joint Spectrum Sharing Proposal, submitted by Constellation, Ellipsat and TRW (Oct. 8, 1993). Joint Proposal and Supplemental Comments submitted by Constellation, Ellipsat, Motorola, and TRW (Sept. 9, 1994). See also letter from LQP to FCC (Sept. 13, 1994).

[24] Notice, note 2, supra, at paras. 29-47.

## III. DISCUSSION

### A. Licensing Procedures

#### 1. Qualification Requirements

11. As discussed in the Notice, unless otherwise proscribed by rule, statute or treaty, the Commission has traditionally adopted qualification requirements for each satellite service that reflect the nature of and entry opportunities for the particular service being licensed. Where entry opportunities for a particular service are limited, our threshold qualification requirements for that service are designed to ensure that those awarded licenses can expeditiously implement state-of-the-art systems that further the public interest. If applicants are unable to meet the basic qualifying criteria, their applications are dismissed without additional hearing.

##### a. Technical Qualifications

###### i. Orbit Considerations

12. In the Notice, we proposed to require MSS Above 1 GHz systems to operate in non-geostationary orbits.[25] Because of their lower altitude orbits, LEO systems "can shorten the transmission time between two earth stations, serving to reduce or eliminate the time delay that may now be present in [GSO] satellite-delivered telephone service."[26] We also stated that the Communications Act specifically requires us "to encourage the provision of new technologies and services to the public."[27] We noted that LEO satellite systems, which cover higher latitudes than GSO satellites, and provide a variety of low power links to and from terrestrial equipment, represent such a new technology. We also noted that the inherently global nature of LEO systems offers a broad range of public interest benefits for the United States, including increased possibilities of U.S. leadership in developing and implementing satellite technology, and enhanced U.S. global competitiveness in telecommunication. We suggested that the unique features of LEO systems would foster social and economic benefits throughout the world.

13. We requested comment on the potential for MSS Above 1 GHz systems to generate social, economic, and technical benefits, both domestically and globally, and the extent to which these benefits are realizable with LEO and GSO satellites. We also asked applicants to specify the extent to which their proposed systems will foster these goals and the manner in which their services are planned to be offered. Prospective customers were asked to specify their anticipated use or uses of MSS Above 1 GHz systems, including a discussion of whether

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[25] Id. at paras. 20-22; proposed § 25.143(b)(1).

[26] Id. at para. 22.

[27] 47 U.S.C. § 157.

equivalent services can be provided by LEO and GSO facilities and whether, and the extent to which, alternative terrestrial services are available.

14. AirTouch Communications (AirTouch), Constellation, Ellipsat, LQP, Motorola, Novacom Inc. (Novacom), and TRW support our proposal to require MSS Above 1 GHz systems to operate in LEO orbits. The range of technical benefits to the United States and world communities by LEO systems includes virtually instantaneous voice transmissions, broader geographic coverage, use of low power handheld transceivers and small antennas. AMSC, Comsat, Mobile Communications (Comsat), Mobile Datacom Corporation (Mobile Datacom), and Newcomb Communications, Inc. (Newcomb) do not support our proposal. They argue that there will be no significant qualitative or quantitative difference in the time delay experienced by users of GSO and non-GSO systems and that GSO systems are capable of providing services to most of the Earth. They further argue that LEO technology is subject to shadowing outages,[28] is more complex , and is unproven.

15. We adopt our proposed LEO design requirement. First, AMSC has not convinced us that our assumption regarding the time delay in high altitude GSO systems was in error. While system processing times associated with non-GSO satellite handoffs may be marginally longer than the 18 milliseconds noted by LQP, AMSC has not shown that a GSO system's typical voice transmission delay of some 250 milliseconds, or even longer for multiple hops, is not noticeable to users.

16. Further, LEO systems are significantly superior in their coverage capabilities. While GSO systems can provide coverage to most of the world, this coverage is limited in areas of high latitude, including parts of Alaska. AMSC concedes that GSO systems can provide only "near" total coverage of the Earth. Although GSO systems are capable of providing acceptable services across most of the Earth's surface, LEOs are capable of providing truly global coverage. LEO technology, for example, may enable residents of remote parts of Alaska to have individual telephone access for the first time. There is nothing in the record to suggest that provision of such broad geographical service reduces the capacity of LEO systems to serve more concentrated areas, as AMSC suggests. The public interest would be best served by the technology that offers the broadest potential coverage.

17. The use of handheld transceivers also is facilitated by LEO systems. LEO satellites' lower power levels alleviate the need for large antennas aboard the spacecraft and reduce transceiver weight and volume, enhancing their portability. By contrast, AMSC suggests that handheld transceivers are not contemplated by GSO systems.[29] Its immediate plans do not

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[28] Shadowing occurs when transmissions from the satellite or mobile transceivers are blocked by buildings and vegetation. Shadowing also occurs to GSO systems when the user transceiver terminal is located on a vehicle.

[29] AMSC Reply Comments at 3, n. 1.

include handheld capability, though its second generation system is expected to support them. [30] As we embark on the promise of new mobile technologies, we find it in the public interest to permit the timely deployment of personal communications services that include the broad use of handheld transceivers.

18. One risk cited by AMSC is the increased possibility that the satellites in the LEO constellation will collide with other objects in space. We do not view this as stifling LEO technology. Both the likelihood of collisions and future mitigation methods are being discussed in domestic and international fora. However, the record in this proceeding does not support a finding that space collisions will become a significant problem for LEO systems. We also acknowledge that the reception shadowing associated with LEO satellite movement relative to the Earth's surface (which AMSC suggests would adversely affect signal quality during voice communications) may add to the operational challenges confronting LEO MSS technology. There is no showing, however, that shadowing is more of a problem with LEO technology than it is with GSO technology.

19. Advocates of both GSO and LEO systems argue that their technology will offer economic and social benefits, domestically and globally. The essential advantage of GSO systems is their proven capability to provide telecommunication services. Intelsat and Inmarsat are but two examples. These successes, however, are not sufficient to preclude embracing a new and potentially more efficient technology, notwithstanding its substantial risks and costs. On the contrary, the Commission has a mandate to encourage new technologies and services.[31] While both LEO and GSO systems portend substantial opportunities for employment growth and export of U.S. technologies worldwide, LEO systems have greater potential to serve more uniformly the United States and international locations with smaller, more ubiquitous and lower power equipment. This leads us to conclude that the primary use of the subject spectrum should be by LEO systems. We therefore adopt Section 25.143(b)(2)(i) as proposed in the Notice.

20. Most commenters agree that it would it be difficult for GSO and LEO systems to operate MSS services together in this band. Indeed, this was a significant factor in our decision to propose limiting the 1610-1626.5/2483.5-2500 MHz band to LEO systems. Notwithstanding our decision to adopt a LEO design requirement, we would consider authorizing a GSO system in these bands upon a showing that its operations would not cause interference to or affect LEO operations. Similarly, the provision of radiodetermination satellite services (RDSS) by either LEO or GSO systems would be permissible if fully compatible with licensed LEO MSS systems.[32]

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[30] Id.

[31] 47 U.S.C. § 157.

[32] See 47 C.F.R. § 25.141(f).

ii. Global vs. Regional Coverage

21. In our Notice, we discussed the geographic coverage we would require these satellite systems to provide. In view of our interest in furthering the creation of the global information infrastructure, we proposed to require each MSS Above 1 GHz applicant to demonstrate that its proposed system is capable of providing mobile satellite service to all areas of the world, with the exception of the polar regions, for at least 75% of every 24 hour period. Specifically, we proposed that Big LEO satellite systems be designed so that at least one satellite would be visible above the horizon at an elevation angle of at least 5° for at least 18 hours each day at latitudes less than 80°.[33]

22. The commenters generally support this requirement. They disagree, however, on the extent to which systems must offer service in or near the polar regions. The majority, including the system applicants, agree that there is little need for a requirement to serve unpopulated areas. They argue that the additional costs associated with such service would not be justified. For example, TRW suggests that service up to 80° northern and southern latitudes may not be necessary, because there are no populated areas that far north or south and the economic costs of requiring such service are high. Ellipsat favors requirements of 55° Southern Latitude and 75° degrees Northern Latitude, to cover all but the most remote population centers. The parties to the Joint Proposal modify their previous positions by suggesting a coverage requirement of up to 70° North Latitude and 55° South Latitude.

23. As noted, LEO systems are capable of providing service to all points on Earth. We recognize, however, the need to balance system cost against geographical service area. We agree with the commenters that it is sufficient, given projected need and alternative service options, to require service only to populated areas. We therefore require that Big LEO systems be capable of serving locations as far north as 70° latitude and as far south as 55° latitude. This will allow coverage to populated areas that cannot be reached by GSO systems. While ships and airplanes may traverse the polar regions beyond these latitudes, they are not necessarily deprived of service because the LEO satellites may, in fact, be visible.

iii. Continuous Coverage of the Fifty States

24. We indicated in the Notice that the public interest would be served if LEO systems provided efficient and ubiquitous voice service to users throughout the United States. We therefore proposed to require each LEO system to have at least one satellite at an elevation angle of at least 5° at any given time in all areas of the United States.[34]

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[33] See Notice, note 2, supra, App. A at 1152; proposed Section 25.143(b)(2)(ii).

[34] See id.; proposed Section 25.143(b)(2)(iii).

25. Several commenters note that we proposed to require global "mobile satellite services" in proposed Section 25.143(b)(2)(ii) and domestic "voice" service in proposed Section 25.143(b)(2)(iii). Our expectation is that LEO system operators will have market incentives to offer more than merely voice services, but for purposes of consistency we will revise proposed Section 25.143(b)(2)(iii) to read "mobile satellite services." Further, in the Joint Proposal, the parties agree that Big LEO systems should be capable of covering all fifty states, Puerto Rico and the U.S. Virgin Islands. We will amend Section 25.143(b)(2)(iii) to reflect this coverage.

b. Financial Qualifications

26. In light of the enormous costs involved in constructing and launching a satellite system, we have always considered financial ability a significant factor in determining whether an applicant is qualified to hold a license. Historically, the Commission has fashioned financial requirements for satellite services on the basis of entry opportunities in the particular service being licensed. This stems from our repeated experience that licensees without sufficient available resources spend a significant amount of time attempting to raise the necessary financing and that those attempts often end unsuccessfully.[35] Consequently, where a grant to an under-financed applicant may preclude a fully capitalized applicant from implementing its plans, and service to the public may be consequently delayed, we have required a stringent financial showing to ensure that the public interest would be served.[36] We have required a less stringent financial showing where grant to an under-financed applicant will not prevent another from going forward. For example, we required only a detailed business plan in the radiodetermination satellite service, where all applicants could be accommodated and future entry was possible.[37] In contrast, we required evidence of full, irrevocable financing in the domestic-fixed satellite

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[35] See, e.g., National Exchange Satellite, Inc., 7 FCC Rcd 1990 (Com. Car. Bur. 1992); Rainbow Satellite, Inc., Mimeo No. 2584 (Com. Car. Bur., released Feb. 14, 1985); United States Satellite Systems, Inc., Mimeo No. 2583 (Com. Car. Bur., released Feb. 14, 1985) (domestic satellite licenses declared null and void for failure to begin implementation as required by license). In addition, Geostar Corporation, a start-up company licensed in the radiodetermination satellite service, declared bankruptcy nearly five years after its licenses were issued. It had not built any of its satellites.

[36] This approach has not prevented smaller firms from participating in the satellite services market because ownership of a space station is not mandatory. Space station capacity can be leased or bought, and earth stations can be acquired at relatively low costs.

[37] Amendment of the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 104 FCC 2d 650 (1986) (RDSS Licensing Order). We note that none of the four entities awarded licenses implemented their proposed systems, with the last remaining licensee, Geostar Corporation, declaring bankruptcy in 1991.

service, where applications to implement space stations regularly exceed the number of available orbital locations for those satellites.[38]

27. The Negotiated Rulemaking Committee could not agree to a method by which all six proposed systems could be licensed. Further, the sharing plan we proposed in the Notice, and which we adopt today,[39] does not accommodate all pending applicants and leaves little or no spectrum available for expansion of existing systems or the development of future MSS systems within the United States. Consequently, consistent with our past practice, we seek to ensure that those applicants awarded Big LEO licenses have the financial ability to proceed.

28. The domestic fixed-satellite standard was developed to serve the public interest by deterring warehousing and inefficient use of valuable orbit spectrum resources. Given the same public interest concerns here, we proposed in the Notice a financial standard for the Big LEO service identical to the one used in the domestic fixed-satellite service, noting that a lesser standard could allow permittees to tie up scarce spectrum resources while preventing other qualified entities from providing service to the public.[40] Thus, we proposed to require Big LEO applicants to provide evidence of current assets, operating revenues, or irrevocably committed debt or equity financing sufficient to meet the estimated costs of constructing and launching all planned satellites, and operating the system for the first year.[41]

29. The four parties to the Joint Proposal suggest using a less stringent financial standard that requires an applicant to show "financial preparedness, including reliance on projected revenues and future public offerings" in order to be granted a construction permit. Within one year from the date of the grant of a license, each permittee would be required to demonstrate that it meets the domestic fixed-satellite service financial standard with respect to 25% of the total constellation construction and launch costs. LQP, in contrast, argues that this proposed relaxation of financial standards must be balanced against the concern that only viable applicants be licensed.[42]

30. We conclude that although more relaxed approaches may be used for some satellite services, a strict financial requirement is warranted for the Big LEO service. The proposed Big

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[38] Licensing Space Stations in the Domestic-Fixed Satellite Service, 50 Fed. Reg. 36071 (Sept. 5, 1985) (1985 Processing Order).

[39] See paras. 44-45, infra.

[40] 1985 Processing Order, note 38, supra, at para. 8.

[41] Notice, note 2, supra, at para. 27. We noted that "first year operational costs" were to be calculated for the year following the launch of the first satellite in the constellation.

[42] See Letter from Chairman, Loral Corporation to Christopher B. Galvin, Motorola, Inc. (Sept. 13, 1994).

LEO systems will cost between $97 million and $2 billion to implement. These are, by far, the most expensive satellite systems to date. As we indicated in the Notice, our experience with the satellite industry has proven that arranging financing for any space station system, even one significantly less costly than a Big LEO system, is extremely difficult, even after a construction permit has been granted.[43] Consequently, adopting a lesser financial standard than the domestic fixed-satellite standard, such as the one suggested in the Joint Proposal, could tie up spectrum for years, with contrary to the public interest. While system implementation milestone requirements[44] will provide a mechanism by which to revoke the licenses of those entities that are not capable of going forward, this process takes considerable time and can delay qualified entities from implementing systems and providing service to the public.[45] Because all pending Big LEO applicants cannot be accommodated and because there appears to be no room for future entry, granting an under-financed space station applicant a license may preclude an applicant that possesses the necessary financial resources from implementing its plans, and consequently service to the public may be delayed. Accordingly, we conclude that a financial demonstration identical to the one used in the domestic fixed-satellite service, as proposed in the Notice, should be adopted for the Big LEO service.

31. Applicants relying on internal financing need not set aside specific funds for their systems. Rather, as in the domestic fixed-satellite service, we require only a demonstration of current assets or operating income sufficient to cover system costs. The availability of internal funds sufficient to cover a system's costs provides adequate assurance at the time the Commission acts on the application that the system can be built and launched. Current assets -- which includes cash, inventory, and accounts receivable -- provide a general measure of a company's ability to finance the project itself or to raise funds from lenders and equity investors on the basis of its on-going operations. Highly capitalized companies possess more collateral and, thus, are in a better position to borrow money than thinly capitalized companies.

32. Further, "irrevocably" committed external financing is financing that has been approved and does not rest on contingencies which require action by either party to the loan or equity investment. In other words, the instrument of financing must demonstrate that the lender

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[43] See note 35, supra.

[44] See paras. 188-193, infra.

[45] For example, ABCI, Rainbow, and USSSI were granted domestic fixed-satellite licenses in early 1983. Those licenses were not declared null and void until two years later, shortly before action was taken on the next processing group of domsat applications. Applications in that particular processing group had been on file since late 1983 and action on that group was delayed, in part, by the ABCI, Rainbow, and USSSI proceedings. See, e.g., United States Satellite Systems, Inc., FCC 83-602 (released Jan. 23, 1984) (granting USSSI an additional six months in which to complete its financing), Mimeo No. 2583 (released Feb. 14, 1985) (revoking USSSI authorizations), FCC 85-394 (released Aug. 29, 1985) (denying USSSI's applications for review).

has already determined that the applicant is creditworthy and, absent a material change in circumstances, is prepared to make the loan immediately upon grant of a Commission authorization.[46] This is not to preclude applicants from relying on operating revenues from the initial operations of their systems to finance the remainder of their systems. Nevertheless, to ensure that the system is completed in a timely manner if revenues are not available as soon as anticipated, we require a commitment that a lender is prepared to finance the entire cost of the system.

33. Some of the applicants argued in their comments[47] that a more relaxed standard is supported by our use of a less stringent financial requirement in the radiodetermination satellite service (RDSS) and the non-voice, non-geostationary (NVNG) service. These parties argue that the unproven nature of the RDSS and NVNG services led to the adoption of a financial standard that permitted applicants to finance the systems as they are built and deployed, and that similar considerations apply in the Big LEO service. Our primary reason for the "relaxed" standard in the RDSS and NVNG services, however, was that all pending applicants could be accommodated and future entry was possible.[48] Consequently, a grant to an under-financed applicant would not preclude another qualified entity from going forward. The financial qualification standard adopted for RDSS and NVNG services is therefore inappropriate for Big LEOs.

34. Some of the applicants also argue that we should require only a demonstration of partial financing. They contend that applicants that have the financing to meet construction and launch costs for the number of satellites needed to provide limited domestic and global service will be able to finance the remainder of their systems with the operating income from these services. Such a position, however, would not promote the global availability of this service. A system that relies too heavily on operating income from its first satellites for its completion could easily become stalled before it is able to provide domestic or global service that meets our service requirements.[49] Any applicant that cannot demonstrate the capability to launch more than a limited number of satellites should not be considered for licensing at the expense of potential entrants that could provide global service and continuous domestic service.

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[46] For example, a change in general market conditions or in the applicant's creditworthiness is an acceptable limitation on the lender's commitment to make the loan. Further, a lender is not required to lend the applicant the entire sum at once. Rather, funding can be staggered to reflect the system's implementation schedule or the applicant's need to access those funds. See Licensing Space Stations in the Domestic-Satellite Service, 101 FCC 2d 223 (1985) (1985 Processing Group Notice of Proposed Rulemaking), at para. 22.

[47] We will address all concerns raised in the comments even though they may be inconsistent with the positions taken by the applicants in the Joint Proposal.

[48] See Notice, note 2, supra, at 1108; RDSS Licensing Order, note 37, supra; Report and Order in CC Docket No. 92-76, 8 FCC Rcd 8450 (1993) (NVNG MSS Order).

[49] See para. 29, supra.

35. Ellipsat comments that we should require applicants relying on internal funds to demonstrate a management "commitment" to expend those funds for the Big LEO project. Ellipsat argues that this requirement would put companies with greater capital assets on an even footing with smaller applicants who must rely on "irrevocable" outside loan commitments to establish their financial qualifications. As we stated in adopting the domestic-fixed satellite standard, we will not require management to set aside specific funds for the system. We will, however, require applicants relying on internal assets to provide a balance sheet demonstrating current assets or operating income sufficient to meet the space segment costs together with evidence of a management commitment to the project. This does not require an unalterable commitment that the funds will be expended regardless of market conditions. Rather, consistent with our approach to credit arrangements provided by outside sources, management of the corporation providing the funding must commit that absent a material change in circumstances, it is prepared to expend the necessary funds.[50] Those applicants relying on financing from parent corporations must make the same showing with respect to the parent corporation's commitment.

36. AMSC urges that, given the short life of LEO satellites, we should require the applicants to demonstrate the financial capability to build an entire constellation and a fleet of replacement satellites. Although some of the proposed systems use satellites with a short life, a requirement to demonstrate full funding for these before the first generation is built would be exceptionally onerous and unnecessary. We are confident that after constructing and operating a full fleet of satellites, a licensee would have ample incentive and resources to implement replacement satellites, unless there is insufficient demand. In that case, however, the public would not be harmed by discontinuation of the licensee's service.

37. We recognize that applicants may be able to provide the service requirements adopted today with fewer satellites than proposed in the pending applications. In such a case, an applicant has the option, of course, to modify its pending application to specify only those satellites necessary to meet our minimum requirements, and its financial and technical showing would need to cover only such a constellation. It could then apply to expand its constellation as originally envisioned, as it attains the financial capability to do so.

38. Consequently, to meet the public interest objective of ensuring prompt initiation of this new satellite service, we adopt our proposed rule that requires each Big Leo applicant to demonstrate the ability to build and launch all satellites for which it has applied, which includes those satellites necessary to fulfill our service requirements, and to operate its system for one year after launch of the first satellite in its constellation. In doing so, however, we shall modify our eligibility requirements somewhat in an effort to achieve greater participation by the applicants in this processing group.

39. First, consistent with our paramount objective of securing early implementation of these satellite services, we shall adopt a rule, consistent with our proposal in the Notice, that

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[50] See 1985 Processing Order, note 38, supra, at n. 26.

will enable applicants who can now demonstrate their financial qualifications to receive priority in obtaining license grants. Thus, any applicant who can submit a complete, amended application on or before November 16, 1994, and demonstrates financial capability under the standards set forth in the rule adopted in this proceeding, will be processed immediately. Assuming sufficient spectrum is available to award licenses to all such financially and otherwise qualified applicants, we will grant licenses to these applicants. Given the the national and other public interest benefits of ensuring the United States' global leadership in providing these important new satellite services, we also plan to process these applications on an expedited basis, with action anticipated by January 31, 1995. Making these grants promptly will enable such fully qualified applicants to begin immediately the time-consuming process of satellite construction, thereby significantly assisting in United States' efforts to complete the international coordination process and achieving our statutory and public interest objective of bringing new and innovative services to the public at the earliest possible time.

40. We also wish, however, to accord some processing priority to other applicants in this group who may need more time to establish their financial qualifications, and who have all devoted significant time, effort and resources towards establishing the Big LEO service both domestically, in the Negotiated Rulemaking, and internationally. For example, until feeder link frequencies can be assigned to a particular system, which will not likely occur until after the next World Radio Conference to be held in November 1995 (WRC-95), it may be difficult for some of these applicants to finalize financial arrangements for their systems. Consequently, in an effort to afford an additional opportunity for entry by such applicants, we will allow applicants who cannot meet our financial qualifications requirement at this time an additional period of time to establish their qualifications. Specifically, we will require these applicants to file amended applications by November 16, 1994 to ensure their continued consideration, but we will allow them until January 31, 1996 -- two months after the completion of WRC-95 -- to demonstrate compliance with the financial standard adopted today.

41. Under our two-tiered eligibility rule, applicants who make a decision to defer their financial showing until January, 1996, will not jeopardize their status in the current processing group. Specifically, new applications for Big LEO systems will not be considered until after action on the six pending applications is completed. Nevertheless, such applicants will not be accorded the same processing priority as those applicants who are willing and able to demonstrate their financial qualifications far sooner, by November 16, 1994, and whose expeditious grants will better enable us to achieve early and successful international coordination and implementation of this service. Because the spectrum sharing plan we adopt today accommodates up to five systems,[51] we also recognize that applicants choosing not to make a financial showing until January 1996, may find their applications are mutually exclusive situation. Nevertheless, we believe a very significant likelihood exists that our financial eligibility rule will result in more of these applicants obtaining grants and that, in the intervening time frame until January 1996, events may occur that avoid mutual exclusivity altogether.

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[51] See paras. 44-45, infra.

42. If it turns out that all six applicants are able to estabish their financial qualifications by the November 16, 1994 deadline for amended applications, or alternatively, that all six applicants defer their financial showings until January 1996 and all are then deemed financially qualified, we will implement the auction procedure described below, paras. 88-97, to award licences. If, however, some grants have been made prior to January 1996, and a mutually exclusive situation arises then, the auction procedure outlined below cannot be used. However, given the uncertainty that such a situation will ever arise, we will not at this time decide how to process any such remaing mutually exclusive applications. Presumably, however, such grants would be awarded through an auction mechanism that is appropriate in the circumstances. We have decided, however, to defer any final decision on that issue at this time.

2. Spectrum Sharing Plan

a. Background

43. - As we discussed in the Notice, the six applicants proposed two system designs (LEO and GSO) and two system architectures (CDMA and TDMA/FDMA). A CDMA architecture would permit multiple systems to share the same frequencies. A TDMA/FDMA architecture would operate bi-directionally in a portion of the 1.6 GHz band only and would require each system to operate on discrete frequency band segments. The Committee's work plan called for the Committee to develop rules that would maximize multiple entry and avoid or resolve mutual exclusivity among the six applications. The applicants, however, could not develop a set of technical parameters and sharing criteria that could accommodate all proposed systems. In the Notice, we proposed a sharing plan that could accommodate up to four CDMA systems and one TDMA/FDMA system.[52] The plan was based, in part, upon partial settlement proposals filed by two groups of LEO applicants after the Negotiated Rulemaking was concluded.[53] The plan proposed to assign licensees implementing CDMA systems in the United States to 11.35 MHz of shared bandwidth at 1610-1621.35 MHz. It proposed to assign a TDMA/FDMA system operating in the United States to 5.15 MHz of dedicated bandwidth at 1621.35-1626.5 MHz. If only one CDMA system is implemented, the plan proposed to adjust the domestic assignment for that system to 8.25 MHz at 1610-1618.25 MHz, leaving the freed 3.15 MHz of spectrum available for possible reassignment to the TDMA/FDMA licensee or for new entry. We also tentatively concluded that CDMA systems would be provided with equal amounts of downlink and uplink spectrum, unless CDMA system proponents could demonstrate an unequal assignment was warranted.

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[52] Our plan included both system architectures for two reasons: (1) the record did not support a finding that one architecture is superior to the other, and (2) the plan would permit up to five systems to be licensed, furthering our multiple entry policy.

[53] See note 23, supra.

b. The Basic Plan

44. All five applicants proposing LEO systems agree that our plan provides a basis for accommodating five LEO systems. None takes issue with the framework of the plan: up to four CDMA systems can share 11.35 MHz of bandwidth in the 1.6 GHz band and that one TDMA/FDMA system can operate over 5.15 MHz of dedicated bandwidth. Constellation, for example, states that 11.35 MHz can "support competitive CDMA systems operating in a sharing environment."[54] Motorola supports awarding a single TDMA/FDMA license in 5.15 MHz of bandwidth.[55] LQP, TRW, and Ellipsat all agree that both LEO transmission techniques can be accommodated, with CDMA systems operating on shared spectrum. Indeed, the four proponents of the Joint Proposal, supported by LQP, explicitly agree to an 11.35 MHz/5.15 MHz spectrum split.

45. Despite its general agreement that its system could be accommodated in 11.35 MHz of shared spectrum, Constellation contends in its comments that all five LEO applicants should be given equal options to use the spectrum. Specifically, it argues that adoption of rules requiring four LEO applicants share spectrum, while allowing the remaining applicant to have exclusive use of its own band segment or assigning prime spectrum to one applicant and impaired spectrum to another, would violate the doctrine enunciated in Ashbacker Radio Corp. v. FCC, 326 U.S. 327 (1945) (Ashbacker). We do not agree that a rule requiring sharing by applicants proposing CDMA systems, and that permits other applicants to have exclusive spectrum, implicates Ashbacker. Such a rule is merely a reasonable exercise of our rulemaking authority, based upon the technical characteristics of the systems involved. We also note that the CDMA applicants agreed to a band sharing plan. Indeed, Constellation agrees that its system can be accommodated in a shared band. Consequently, we adopt the plan's basic framework.[56]

46. Despite their general support for the plan, all LEO applicants request some modifications or clarifications. The requests center around three issues: (1) what portion of the 2.4 GHz MSS downlink band will be available to the CDMA licensees; (2) whether MSS operations in the lower 6 MHz of the 1.6 MHz band will be impaired by GLONASS, the Russian Global Navigation Satellite System, and radioastronomy service (RAS) operations in that band; and (3) whether the 11.35 MHz CDMA assignment will be automatically reduced to 8.25 MHz should only one CDMA system become operational. We discuss these in turn.

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[54] Constellation Comments at 19.

[55] Motorola Comments at 47, n. 35.

[56] See Final Report of the Majority of the Active Participants of Informal Working Group 1 to Above 1 GHz Negotiated Rulemaking Committee, Annex 1 (Attachment 1 to Committee Report) and Joint Proposal, note 23, supra.

c. Downlink Assignment

47. In the Notice, we assumed that CDMA systems assigned to share the 1.6 GHz uplink spectrum would require a corresponding amount of 2.4 GHz downlink spectrum. We requested comment on this assumption. All CDMA operators strongly disagree, arguing in their comments and in the Joint Proposal that CDMA applicants should be allowed to share the entire 16.5 MHz of 2.4 GHz downlink spectrum allocated to MSS. They argue that the systems must operate over the entire bandwidth to achieve maximum capacity at minimum cost. According to the CDMA proponents, if the number of satellites transmitting in any segment of the 2.4 GHz band is minimized, the satellites' cost can be substantially reduced. They also argue that the 2.4 GHz band is already constrained by international and domestic power flux density (pfd) limits and other existing services, which limits the number of users that can be served, and that any limitations on bandwidth will further affect system capacity.

48. We are convinced that the entire 16.5 MHz of spectrum allocated domestically and internationally at 2483.5-2500 MHz should be assigned to Big LEO system downlinks in the United States. There is no compelling reason to restrict use of this band. Indeed, assignment of the entire band should provide operators with sufficient flexibility to coordinate their operations with other Big LEO systems in the band and to accommodate other users in the band or in adjacent bands with little or no corresponding loss of capacity. Consequently, we will provide CDMA operators with access to the entire allocated 2.4 GHz band. Moreover, only satellite systems using CDMA will be permitted in this band.

d. Interim Plan

49. As we discussed in the Notice, interference problems between MSS and certain proposed applications on GLONASS, the Russian Global Navigation Satellite System, will not permit co-frequency co-system coverage in the United States and internationally in the 1610-1616 MHz band. Specifically, if GLONASS is used in conjunction with the U.S. Global Positioning System (GPS) to provide aircraft precision approach and terminal communications, as contemplated by the Federal Aviation Administration (FAA), MSS would not be able to operate in the shared band because of the potential for MSS mobile terminal interference into GLONASS mobile receivers.[57] We indicated in the Notice that we had initiated inter-agency and

[57] The FAA and the International Civil Aviation Organization (ICAO) are investigating using the GLONASS and GPS systems in a joint Global Navigation Satellite System (GNSS) that can support the civil aviation community with the integrity that is required to provide for precision approach landings. The Russian Federation is now launching a second generation of GLONASS satellites, GLONASS-M, which is operating over 24 channels in the 1596.7-1620.6 MHz band. GLONASS-M has not been coordinated internationally. Approximately 40 administrations, including the United States, have submitted comments or objections to the ITU Radiocommunication Bureau with respect to GLONASS-M. However, the Russian Federation has been coordinating the GLONASS-M system and has indicated that it has resolved most of

international negotiations regarding the use of GLONASS and were encouraged that even if GLONASS were ultimately used to provide services incompatible with MSS, the GLONASS final frequency plan would be changed to bands below 1606 MHz only, making the 1610-1616 MHz band available for MSS operations.[58] We recognized, however, that a GLONASS transition to bands below 1606 MHz may not be completed when the first MSS satellites are launched in the late 1990's. In that case, we stated we would need to develop a transitional plan for MSS migration into the vacated 1610-1616 MHz band "with MSS licensees operating on less than the full amount of their assigned spectrum during the initial phases of their operation."[59]

50. The applicants agree in their Joint Proposal that if GLONASS is not moved in a timely manner, the Big LEO licensees should share the burden of any spectrum loss. They argue, however, that we need not develop a transitional plan now, but, rather, that we should allow the parties to negotiate and reach such an agreement in the event GLONASS compromises MSS operations. Both Motorola and LQP argue in their comments that an interim plan would impede MSS by suggesting to GLONASS equipment manufacturers and other countries that they need not plan for the change in GLONASS frequencies and may lead to the view that revision of the GLONASS frequency plan is optional.

51. Our ongoing discussions with other agencies and with the Russian Federation continue to clarify the GLONASS issue. While we are confident that GLONASS will be moved to bands below 1606 MHz, we do not know when a full transition will occur. At our most recent bilateral discussions, the Russian Federation suggested that a GLONASS migration may not begin until 1998 and may not be completed until 2005.[60] We do not know whether GLONASS operations, before a migration to the final frequency configuration, will affect MSS CDMA systems operating in the lower frequency portion of the 1.6 GHz band, domestically or internationally. This depends upon two related factors: (1) the extent to which domestic and international civil aeronautical agencies and organizations (such as ICAO) use GLONASS to

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the objections by these administrations.

[58] The Russian Federation has indicated a willingness to use channels 0-12 (1602-1608.75 MHz center frequency) commencing in 1998. A guardband of approximately 4 MHz would be required to protect GLONASS-M narrowband signals from ground-based Mobile Earth Station (MES) out-of-band radio frequency emissions on aviation GNSS receivers using GLONASS signals.

[59] Notice, note 2, supra, at n.59.

[60] The Russian Federation has indicated that it can operate on channels -7 to +6 after 2005 (1598 to 1605.375 MHz center frequency). It has also indicated that it would only use channels 5 and 6 as technical channels over the Russian Federation. When this is implemented, GLONASS's highest effective operational channel will be 1604.25 MHz center frequency. Allowing for a 4 MHz guard band, there will then be no restrictions on MSS in the 1.6 GHz band.

provide approach and terminal communications that are incompatible with MSS operations and (2) the extent to which out-of-band emission limitations may be needed for MSS transmissions.[61] Nevertheless, a portion of the 1.6 GHz MSS frequency band may not be available for first-generation domestic MSS operations. At this time, the most likely worst-case scenario is that the 1610-1612 MHz band segment assigned to CDMA systems in our sharing plan may not be available for initial operations in the United States.[62] This is based on the launch and operation schedules outlined in the various applications.

52. We agree with the applicants that the burden of the potential 2 MHz shortfall should be shared among all 1.6/2.4 GHz MSS licensees. We believe, however, that a transitional plan is warranted. Such a plan will allow system launch to begin without potential delay and without the uncertainty associated with allowing the licensees to attempt to devise an interim plan on an ad hoc basis, as the Joint Proposal suggests.[63] In adopting an interim plan, we emphasize that we remain optimistic that the plan will not need to be implemented. Indeed, as provided in the Joint Proposal, all Big LEO operators will be authorized to construct systems capable of operating across the entire band allocated for that system architecture, that is, 1610-1626.5 MHz for CDMA systems and 1616-1626.5 MHz for bi-directional FDMA/TDMA systems. Further, even if the transitional plan is implemented, MSS operators will be permitted to expand into the unused 1.6 GHz MSS frequencies immediately after the GLONASS migration is completed. We

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[61] RTCA, Inc., an advisory committee to the FAA, is studying out-of-band emissions from mobile earth stations among other potential interference sources to GNSS receivers. RTCA, Inc. has formed an Ad Hoc Interference Subgroup (AHIS) of Special Committee 159 (SC-159) on Global Positioning Systems. A special Joint Task Group on SATCOM/GNSS Interference is also studying the mutual problems of electromagnetic compatibility of AMSS and GPS/GLONASS equipment operating on the same platforms or on platforms located at very close distances, i.e., airport terminals. See para. 137, infra.

[62] We note that to the extent MSS systems are launched before 1998, the 1610-1616 MHz portion of the 1.6 GHz band segment might not be available if GLONASS is being used in the GNSS for aeronautical operations. In that case, licensees can begin to implement channels starting from the highest frequency range downwards in conformance with the interim plan. We believe that this should not present significant problems since it will occur at the earliest stages of operations. We also note that it is possible that the FAA will decide not to use GLONASS until it shifts its frequencies to its final configuration. It may be prohibitively expensive for airlines to develop and install equipment using interim standards capable of protecting equipment using GLONASS. In that event, we believe that it is likely that the Russian Federation will advance the date to shift GLONASS frequencies to channel 6 and below as early as possible. The most recent bilateral discussion with the Russian Federation provides for periodic review of this time table and the deployment of the MSS systems in order to resolve any interference.

[63] We will, however, entertain a request for modification of the interim plan if agreed to by all licensees.

believe that any necessary transition among LEO licensees can be completed within six months of that date.

53. Our interim plan is based upon the most recent system designs presented to us in the context of the Negotiated Rulemaking. Four of the CDMA applicants propose to build systems using narrowband 1.25 MHz transmission channels while one -- TRW -- proposes wider 5 MHz channels. If the entire 11.35 MHz assignment designated for CDMA systems were available, the narrowband licensees would be able to operate over 9 transmission channels, while the wider band operator would be able to operate over two. If MSS cannot be provided in the 1610-1612 MHz portion of the CDMA band segment because of GLONASS considerations, two narrowband channels would be lost and one wideband channel would be lost. Allowing CDMA licensees to shift frequencies by 1.25 MHz into the designated TDMA/FDMA band at 1621.35-1626.5 MHz would provide both narrowband and wideband CDMA licensees with access to one additional channel. Consequently, until the entire 1610-1626.5 MHz band is available for MSS operations, we will provide CDMA operators with the option of operating in the 1621.35-1622.60 MHz band segment. In this way, all Big LEO operators will bear some of the necessary operating constraints -- the narrowband CDMA operators by the net loss of one channel, the wideband CDMA operators by the loss of one channel or by the need to retune the center frequencies on both of its channels once GLONASS is fully moved,[64] and the FDMA/TDMA licensee by the loss of operating bandwidth. Nevertheless, we are optimistic that these measures will not be necessary or, if they are, that the effect on the MSS industry will not be significant given their short term nature and the anticipated incremental implementation of Big LEO service.

e. Conditions to the Plan

i. Reduction in Spectrum for Single CDMA System:

54. Another issue raised by the LEO applicants is our proposed modification to the plan in the event only one CDMA licensee goes forward.[65] In this unlikely scenario, we proposed to reduce the bandwidth assigned to that system automatically from 11.35 MHz to 8.25

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[64] The additional interim bandwidth of 1.25 MHz (1621.35-1622.60 MHz) would allow TRW to operate two 5 MHz CDMA channels at 1612.60 MHz to 1617.60 MHz and 1617.60 MHz to 1622.6 MHz. If it chooses to do this, it would be required to move these channels to 1610 to 1615 MHz and 1615 to 1620 MHz once GLONASS is moved. This would require the center frequencies on each channel to be shifted or retuned.

[65] Under the terms of each authorization, Big LEO licensees will be required to meet specified implementation milestones for the system. Failure to meet these deadlines will render the authorization null and void. See para. 189, infra. The bandwidth adjustment discussed here would be triggered only: (1) if no CDMA system is licensed; (2) if only one CDMA system is licensed; or, (3) if more than one CDMA system is licensed and all but one is declared null and void.

MHz. We stated that an 8.25 MHz assignment, or one-half of the available 1.6 GHz MSS allocation, should be sufficient to support a viable system. We noted that the remaining 3.1 MHz of spectrum would be made available to an operational FDMA/TDMA system upon a showing of need or, if this demonstration could not be made, to a new entrant. The four parties to the Joint Proposal suggest that if one CDMA and one FDMA/TDMA system become operational, the 3.1 MHz of spectrum should be available to both of these licensees upon a showing of need and should not be made available to new entrants. In their comments, the CDMA operators argued that an automatic spectrum reduction for a CDMA system with no possibility of adjustment would penalize a CDMA licensee for the failure of another operator to launch a system, that it does not consider the efficiency of the system or whether the CDMA system is sharing spectrum with a foreign system, that it does not give CDMA operators a corresponding opportunity to gain access to bands above 1621.35 MHz upon failure or inefficient spectrum use by the FDMA/TDMA licensee, and that it will seriously impair CDMA operations. They further argued that even if GLONASS is moved, the lower frequency portion of the band is subject to more interservice sharing constraints because of protected radio astronomy operations.

55. The CDMA proponents correctly state that uncertainties are present in the lower portion of the band that are not present in the upper portion. As noted, GLONASS is now operating in 1610-1616 MHz band and we do not know exactly when it will be moved or the limitations its operations will impose on MSS operations. Further, the radioastronomy service (RAS) operates on a co-primary basis in the 1610.6-1613.8 MHz band. The agreement reached by the Negotiated Rulemaking Committee regarding sharing between RAS and MSS imposes restrictions on MSS operations provides certain operating constraints on MSS mobile earth terminals in geographic areas near RAS sites.[66] If RAS sharing proves burdensome or if GLONASS is not fully moved in a timely fashion, an assignment of 8.25 MHz for each of the two LEO system architectures may not prove equivalent. Further, we do not know if, and the extent to which, foreign systems will impact U.S. systems' operations across the entire band. Consequently, we will defer any decision with respect to the 3.1 MHz between 1618.25 and 1621.35 MHz until, and if, either of those contingencies arises. At that time, we will have a clearer notion of the extent of any inter-service sharing constraints in the lower portion of the 1.6 GHz band. We will not, however, limit our consideration for assignment of this band to the two licensed systems, as the parties to the Joint Proposal urge. We do not think it is advisable at this time to preclude new entrants from access to this band. Rather, we will make the decision with respect to the 3.1 MHz, if necessary, in the context of a rulemaking, based upon the circumstances that have developed at that time.

ii. Other Potential Scenarios

56. Although not specifically addressed in the Notice, the four parties to the Joint Proposal have developed a plan in the event that only one system retains a construction permit.

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[66] See paras. 101 - 109, infra.

In this scenario, the Joint Proposal would provide that that system, whether TDMA/FDMA or CDMA, would be given access to the entire 16.5 MHz of bandwidth.

57. We need not decide now on a course of action to be taken in the event that only one Big LEO system is implemented, whether it is a CDMA or TDMA/FDMA system. If and when that occurs, we will weigh a variety of factors in a rulemaking, including our preference for multiple entry, constraints on the assigned spectrum due to international coordination agreements, system efficiency, and system loading, when considering a spectrum adjustment for that system.

f. System Amendments

58. Several of the commenters question whether applicants will be permitted to change their system designs when amendments are filed. TRW, for example, asks us to clarify that a change in transmission techniques from CDMA to TDMA/FDMA following adoption of service rules will not constitute a major amendment under Commission rules. This concern apparently stems from Section 25.116(c) of our rules, which provides, in general, that any pending application is to be considered a newly filed application if it is amended by a major amendment after a "cut-off" date. The rule contains several exceptions, including instances where the amendment resolves frequency conflicts with other pending applications, but does not create new or increased frequency conflicts.[67]

59. We have repeatedly emphasized that MSS Above 1 GHz applicants who filed by the cut-off date will be afforded an opportunity to amend their applications, if necessary, to bring them into conformance with any requirements and policies that are adopted for satellite systems in these bands.[68] Thus, a change from a GSO system configuration to a LEO system configuration to meet our satellite system design requirement or a change in coverage patterns to conform with our satellite visibility requirements would be permitted without affecting a particular application's status in this processing group. However, a change that is not necessary to bring the application into conformance with our rules and which would increase frequency conflicts, such as a change from a CDMA to a TDMA/FDMA architecture, would render the application a newly filed application to be considered in a future processing group.[69] We recognize that if all six of the pending applicants are found qualified under our Big LEO rules, our five-system sharing plan will not be able to accommodate all of them. We discuss in a

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[67] 47 C.F.R. § 25.116(c)(1).

[68] See Notice, note 2, supra, at para. 18 and Public Notice, note 16, supra.

[69] We note that the three CDMA applicants participating in the Joint Proposal have agreed not to change to a TDMA/FDMA architecture.

succeeding section of this Report and Order the procedures that will apply to applicants in these circumstances and that we will follow to decide among the mutually exclusive applications.[70]

g. Inter-System Coordination

60. Several commenters also suggest that we institute formal, but not necessarily codified, procedures or guidelines for CDMA inter-system coordination in the context of adopting a domestic sharing plan. Some suggest that we use the initial sharing proposal submitted to the Negotiated Rulemaking Committee by the CDMA applicants as the basis for a domestic coordination framework. Indeed, the three CDMA applicants participating in the Joint Proposal agree to coordinate their systems in accordance with this framework expeditiously and in good faith.

61. We applaud the CDMA applicants for their good faith efforts to develop a framework for coordination. We have decided, however, not to incorporate these procedures in the Commission's rules. Historically, we have left domestic and separate international system inter-system coordination to the satellite licensees themselves, since they are in the best position to weigh the technical and economic trade-offs inherent in any coordination agreement.[71] This approach has proven successful. Since the CDMA applicants have represented that sharing is feasible, we expect that good faith efforts to resolve any outstanding coordination issues expeditiously in accordance with the Joint Proposal will commence after this Report and Order is issued. If the parties believe that any entity is not negotiating in good faith or if an impasse is reached on any issue, we will, upon request, become involved in the process and, if necessary, will devise a solution.

62. Another coordination issue raised by some of the commenters is whether and the extent to which a guardband is necessary between CDMA and TDMA/FDMA systems and, if so, which architecture should bear the burden. The parties to the Joint Proposal have agreed to develop an emissions mask between the CDMA and TDMA/FDMA band segments that spreads the burden between them. LQP, in contrast, suggests that an emissions mask may override the allocations made at WARC-92 because a mask will, in essence, protect Motorola's secondary downlink transmissions in the 1.6 GHz band.

63. We need not resolve this matter now. Rather, while we recognize that secondary services cannot, as a general matter, claim interference protection from harmful interference from

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[70] See paras. 88-97, infra.

[71] See, e.g., Hughes Communications Galaxy, Inc., 7 FCC Rcd 4672 (1992), at para. 8; GE American Communications, Inc. 3 FCC Rcd 6871 (1988), at para. 2; Assignment of Orbital Locations to Space Stations in the Domestic Fixed-Satellite Service, 50 Fed.Reg. 35228 (1985), at para. 19; RDSS Licensing Order, note 37, supra, at para. 19.

stations of a primary service,[72] we will leave the parties free to negotiate a guardband agreement once the technical parameters of their amended system proposals are finalized. If the parties negotiate an agreement that protects secondary operations, we will accept that solution. If the parties cannot agree, however, we will become involved and will look to the Table of Frequency Allocations to determine where any operational constraints are appropriately placed.

3. Plan If Mutual Exclusivity Is Not Resolved

64. We do not intend to continue our already-prolonged attempt to resolve this proceeding by compromise in the event that mutual exclusivity among the Big LEO applicants is not eliminated by amendments submitted by the November 16, 1994 filing deadline, as there is little reason to suppose that further pursuit of that elusive goal would be useful. In the Notice, we discussed three alternative procedures -- comparative hearing, lottery, and auction -- for resolving this proceeding in the event that the proposed sharing plan did not resolve mutual exclusivity and called for comment concerning the feasibility and/or legal availability of each of them. If an auction or lottery[73] was employed, we proposed to divide the spectrum into paired 2.0625 MHz uplink and downlink segments, with eight paired segments available for licensing. We proposed to limit each successful bidder or lottery winner to an award of up to four 2.0625 MHz paired segments, noting that this should provide ample spectrum to support a Big LEO system while allowing for at least two licensees.[74] We conclude that we can lawfully resolve this proceeding by means of an auction and that, of the three, an auction would better serve the public interest.

a. Comparative Hearing

65. We continue to believe that the prospect of delay in the initiation of service weighs heavily against use of a comparative hearing, particularly in light of the need for prompt participation by U.S. licensees in international coordination.[75] Whether conflict between Big LEO applications could be resolved through a comparative hearing in less time than is typically consumed in comparative hearings involving applications for broadcast licenses -- as TRW, the only commenter advocating use of comparative hearings as a fall-back procedure, contends -- is largely beside the point. Even under the most optimistic assumptions, selection of Big LEO licensees through a comparative hearing is likely to take considerably longer than the use of a lottery or competitive bidding.

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[72] See note 21, supra.

[73] Because the LEO applications were filed prior to July 26, 1993, the Commission is not statutorily prohibited from considering random selection as a licensing option. See Section 6002(e) of Pub.L. 103-66.

[74] Notice, note 2, supra, at para. 45.

[75] Id. at para. 40.

66. We also believe that a comparative hearing would be inadvisable for other reasons. The Commission has previously stated that comparative hearings would be inconsistent with our aim of affording flexibility to satellite licensees.[76] As a general matter, moreover, we are reluctant to substitute our judgment for the wisdom of the marketplace by dictating outcomes based on assessment of the relative merits of applicants' service proposals. We doubt whether we would be able to resolve all conflicts among LEO applications based on findings that certain of the applications are demonstrably technically superior to others. As previously noted, satellite design decisions involve complex trade-offs between engineering, marketing, and financial considerations, which are difficult to evaluate without reference to the functioning of the marketplace.[77] These design decisions are also modified to accommodate regulations, marketplace and financial constraints and uncertainties as these uncertainties become more clearly defined in time.

b. Lottery

67. Constellation is the only applicant that recommends use of a lottery in the event that we cannot accommodate all qualified applicants. It states that it favors this procedure only because it believes that auctions would create unacceptable international ramifications. LQP and TRW, in contrast, maintain that none of the factors listed in the Conference Report on Section 309(i) would support the use of a lottery procedure is present here.[78] LQP, Motorola, and TRW also contend that a lottery would be inappropriate because the pending applications involve technically diverse, non-fungible proposals. LQP and TRW argue that it would be unfair to the existing applicants, who have invested large sums of money in research and development for their proposals, to choose winners by the luck of the draw. TRW warns that a random selection process here would discourage planning and innovation by future applicants. Motorola objects that the results of a lottery would bear no relation to the best use of the available spectrum and would bestow insufficient spectrum or unusable combinations of spectrum-segments upon the winning applicants.

68. We will not use a lottery in this case because we have concluded that awarding Big LEO licenses through the use of competitive bidding procedures would better serve the public interest. Most importantly, an auction would be an economically efficient means of allocation. A well-designed auction produces an outcome approximating allocation to highest-

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[76] See Rules to Allocate Spectrum for Mobile Satellite Services, 6 FCC Rcd 4900, 4904 (1991), at paras. 19-20; and Rules to Allocate Spectrum for a Land Mobile Satellite Service, 2 FCC Rcd 485, 487 (1987), at para. 15.

[77] 2 FCC Rcd at 487, para. 15.

[78] See 47 U.S.C. § 309(i). See also H.R. Conf. Rep. No. 765, 97th Cong., 2d Sess, at 37 (1982).

valued use, which we believe promotes spectrum efficiency and other public interest considerations.[79] Use of competitive bidding procedures would provide participants with the incentive to conceive innovative, cost-effective and spectrum efficient uses for the spectrum-blocks to be assigned and to estimate accurately their potential commercial value. Further, a lottery may produce a haphazard outcome. Although such an outcome might be partially redressed through resale, that would entail further transaction costs. We do not believe that an auction would have significant adverse international ramifications, as discussed below.

c. Competitive Bidding

69. Legality. Having decided that it would best serve the public interest to use competitive bidding in the event that the sharing plan does not resolve mutual exclusivity, we next respond to arguments concerning our legal authority to do so. Section 309(j)(1) and (2) of the Communications Act, as amended, 47 U.S.C. § 309(j)(1), (2), permits auctions where mutually exclusive applications for initial licenses or construction permits are accepted for filing by the Commission and where the principal use of the spectrum will involve or is reasonably likely to involve the receipt by the licensee of compensation from subscribers in return for enabling those subscribers to receive or transmit communications signals.[80] TRW, however, asserts that "the entire thrust and substance" of the legislation authorizing the Commission to assign licenses by auction is "geared toward" licensing for the personal communication service (PCS) service and that the underlying legislative purposes "simply do not apply to . . . an inherently global . . . satellite service [for which] there are currently no more than six applications." However, nothing in Section 309(j) precludes the use of auctions for satellite services, and the scope of our Section 309(j) authority to use auctions clearly is not limited to PCS licensing.[81] Indeed, we have decided to use auctions for many services besides PCS.[82] Nor

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[79] Second Report and Order in the Implementation of Section 309(j) -- Competitive Bidding, 9 FCC Rcd 2348, 2361 (1994) (Implementation of Section 309(j), at para. 73. Moreover, an efficient auction would award licenses more quickly to those that value them most highly and would facilitate the efficient aggregation of interdependent licenses. We also note that the applicants here did not submit their proposals in reliance on an expectation that the Commission would use lotteries.

[80] No commenter disputes the holding in para. 42 of the Notice that Big LEO service will involve a "use of the electromagnetic spectrum" as defined in 47 U.S.C. §309(j)(2), notwithstanding that most of the applicants propose to provide service to resellers rather than end-users. As we noted previously, the legislative record indicates that it is irrelevant to the applicability of the 309(j)(2) definition whether a licensee's subscribers are end-users or resellers, and we believe that understanding is consistent with the plain meaning of the pertinent statutory text.

[81] The legislative record confirms that proponents of the legislation were well aware that it did not merely pertain to PCS licensing. See H.R. Report No. 103-111, 103d Cong., 1st Sess., at 256 (1993) ("[S]ection 309(j) is a generic statute that will govern the issuance of licenses in *many different services*"). See also Implementation of Section 309(j), note 79, supra.

does Section 309(j) withhold authority to use auctions for licensing international satellite systems or specify a minimum number of competing applications for a class of licenses that must be on file in order for licenses to be assigned by competitive bidding.

70. Constellation, Motorola and LQP contend that the statute forbids us from conducting an auction until we have used every means to attempt to eliminate mutual exclusivity. Motorola and LQP cite commentary in the House Report and in a letter from Congressman Dingell to then-Chairman Quello as evidence that Congress "clearly had the Big LEO proceeding in mind when it added this language to the bill" and that it believed that mutual exclusivity could be avoided in this proceeding. Further, TRW and COMSAT cite this commentary as proof that Congress enacted Subsection 309(j)(6)(E) to prevent the Commission from using an auction to assign Big LEO licenses.

71. Nothing on the face of Subsection 309(j)(6)(E), or in its legislative history, indicates that we are prohibited from granting Big LEO licenses by auction. The text of the Section merely provides that the Commission should continue to use techniques that avoid mutual exclusivity among applicants. Similarly, the commentary in the House Report states that it generally serves the public interest for the Commission to use engineering solutions and other mechanisms to avoid or eliminate mutual exclusivity and that the Commission should continue to do so in the Big LEO licensing proceeding. The Report does not assert, however, that if the Commission is unsuccessful in resolving mutual exclusivity, the legislation bars the Commission from auctioning Big LEO licenses. Rather, we construe the provision to mean that the Commission is obliged to attempt to eliminate mutual exclusivity. Indeed, if the Commission could avoid mutual exclusivity in every instance in which it arises, no need would exist for the Commission's auction authority. In the course of this proceeding, we have proposed several spectrum sharing plans to that end.[83] We do not think that it would serve the public interest to continue this effort in the event that the six applications before us, as amended in response to this Report and Order, are mutually exclusive.

72. Regardless of our general authority to conduct an auction in the Big LEO service, TRW contends that we may not auction the allocated 2.4 GHz band downlink frequencies because the pending applications for these frequencies are not mutually exclusive. According to TRW, all four applicants desiring to use the 2.4 GHz band could do so on a shared basis using

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[82] For example, auctions will be used to award licenses in the 900 MHz Specialized Mobile Radio Services and the Mutlipoint Distribution Services. See 47 C.F.R. § 1.2102(a).

[83] See, e.g., Committee Report, Addendum 1 (proposal developed by FCC Representative to the Committee that would have permitted all proposed systems to be licensed with some design modifications); Notice, note 2, supra, at para. 38.

the CDMA technology that all of them propose.[84] Similarly, since the same four applicants are the only ones proposing to use the lower six MHz of 1.6 GHz band, TRW argues that we cannot use auctions to assign authorizations for that frequency range either. As TRW sees it, the only portion of the Big LEO spectrum that we can auction consistently with the mutual exclusivity proviso of Subsection 309(j)(1) is the sector of the 1.6 GHz band between 1616-1626.5 MHz, where both Motorola and the CDMA proponents have competing applications on file.

73. We do not agree with TRW that Subsection 309(j)(1) bars us from using an auction to award licenses for the lower portion of the 1.6 GHz band. There is simply not enough spectrum in the band to accommodate all pending applications. While we recognize that there are certain portions of the spectrum in which sharing among CDMA systems is possible (i.e., the 1610-1616 MHz and the 2483.5-2500 MHz bands), these frequencies cannot in themselves accommodate all proposed CDMA systems, including AMSC's. Consequently, these bands cannot be separated from the rest of the MSS frequencies in determining whether mutual exclusivity exists and whether auctions can be employed. Moreover, we are not proposing to conduct an auction until after the applicants have had an opportunity to amend their applications to conform with our rules. If our spectrum sharing plan does not then accommodate the systems of all qualified applicants, the plan will not be implemented. Rather, the 1.6 GHz band spectrum would be segmented and the qualified applicants will be required, in order to preserve their eligibility, to apply for a separate license for each segment that they want to use. Consistent with the mutual exclusivity prerequisite of Subsection 309(j)(1), In the event that only a single eligible application is filed for a particular segment within the filing window, the segment will be assigned to the applicant requesting it. We would not assign the license for a segment through competitive bidding unless two or more eligible applications for it were on file. Winners would be permitted to employ their choice of CDMA or TDMA/FDMA architectures.

74. We do agree with TRW that there is no need to assign 2.4 GHz band authorizations by competitive bidding. Because CDMA systems must use 1.6 GHz uplink and corresponding 2.4 GHz downlink frequencies to operate, we proposed in the Notice to pair 1.6 GHz and 2.4 GHz spectrum blocks for auctioning.[85] All applicants requesting authority to use the 2.4 GHz band concede that they can share it using CDMA technology, however. We therefore conclude that would be more appropriate to license all winners of auctioned 1.6 GHz spectrum blocks to operate in the space-to-Earth transmission direction in the 2483.5-2500 MHz band on a shared basis using CDMA techniques.

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[84] LQP contends, moreover, that segmentation of the 2.4 GHz band pursuant to the tentative auction plan outlined in the NPRM would be impracticable because any CDMA system would require use of all 16.5 MHz of the available 2.4 GHz band, whether it intends to share that spectrum in common with other CDMA systems or to use it exclusively.

[85] Notice, note 2, supra, at para. 45.

75. TRW contends that dividing sharable spectrum into segments and assigning a license for each segment to the highest bidder, as we proposed in the Notice, rather than assigning co-extensive licenses for the entire bandwidth to as many as could share it, would be "spectrum-inefficient" and therefore "manifestly contrary to the auction legislation." Constellation likewise asserts that assigning licenses for discrete segments of the Big LEO spectrum by competitive bidding would probably eliminate any chance of CDMA sharing, as auction winners would probably not consent to share use of their licensed segments with competing service providers. Constellation, accordingly, contends that such a licensing procedure would not promote efficient spectrum use. Similarly, LQP asserts that assigning Big LEO licenses by auction would deter multiple entry and competition.

76. We do not agree that auctioning the 1.6 GHz band in band segments would disserve the statutory objectives of promoting competition and efficient spectrum use. First, it is not clear that using an auction licensing mechanism would discourage spectrum sharing. Applicants who obtain licenses for band segments by competitive bidding could negotiate post-auction sharing agreements among themselves and request license modifications, as TRW acknowledges in its comments.[86] If, in fact, the potential economic value of some or all of the available 1.6 GHz band could best be realized through frequency sharing, licensees will have an incentive to enter into such mutually beneficial sharing agreements, no matter how they acquire their licenses. Second, there is no evident reason to conclude that competitive bidding would impede competition. Our auction rules will ensure that there will be at least two providers. Further, by dividing the available bandwidth into relatively small segments and allowing bidders to acquire several segments and aggregate them, the number of initial licensees and the amounts of spectrum held by particular licensees will be determined largely by market forces.

77. We recognize it is possible that an auction might result in fewer licensees than could otherwise have been accommodated using a sharing plan. As discussed above, however, we have been unable to develop a sharing plan that avoids mutual exclusivity, assuming all applicants are deemed qualified. If mutual exclusivity cannot be avoided by sharing, implementing an auction may achieve countervailing public interest benefits. As we have explained, assigning spectrum rights to those who place the highest value on them generally serves the public interest because it ensures an award to the highest-valued use.

78. We do not agree with LQP that using auctions is contrary to our established policy of favoring multiple entry in new satellite services. We have ensured that our competitive bidding framework will result in at least two licensees, thereby ensuring the benefits of a competitive market structure.[87] Moreover, insofar as our policy permits marketplace incentives

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[86] TRW Comments at 102-103.

[87] See para. 89, infra.

to determine the number of service providers, the policy is fully consistent with our "open skies" satellite policy, which was based on similar considerations.[88]

79. TRW also suggests that we may not lawfully use an auction to assign Big LEO licenses because of the statutory mandate concerning promotion of economic opportunity. TRW claims, for instance, that the statute requires the Commission, consistent with the public interest and the characteristics of the proposed service, to "prescribe ... bandwidth assignments that promote ... economic opportunity for a wide variety of applicants" (emphasis added),[89] which is impossible here given the number of Big LEO licenses that can be awarded. TRW further asserts we cannot meet the statute's requirements to afford opportunity for small businesses, businesses owned by members of minority groups or women, and rural telephone companies, since there are no representatives of those "designated entity" (DE) classes among the existing applicants, that it is virtually impossible for a company qualifying as a small business to raise enough capital to finance construction and operation of a Big LEO system, and that it would be a daunting task to devise a system of viable set-asides for designated entities without drastically impairing the ability of other applicants to implement service.

80. Subsection 309(j)(3) requires the Commission to seek to promote "economic opportunity and competition," among other goals, "by disseminating licenses among a wide variety of applicants, including [DEs]," and Subsection 309(j)(4)(D) directs us to ensure, when prescribing regulations governing auction procedures or eligibility to apply for licenses to be assigned by auction, that DEs are given an opportunity to participate in the provision of spectrum-based services. The statute, however, directs the Commission, in specifying auction procedures, to pursue other objectives, aside from ensuring opportunity for DEs. Among these are the goals of promoting "the development and rapid deployment of new technologies, products, and services for the benefit of the public, including those residing in rural areas, without administrative or judicial delays" and of promoting "efficient and intensive use of the electromagnetic spectrum." 47 U.S.C. § 309(j)(3). In the Notice, we tentatively concluded auctions would further these objectives and we affirm these conclusions in this Report and Order.[90] The statute also implicitly leaves it to the Commission to strike a balance in the public interest among the statutory objectives.[91] Here, only six applications are being considered. No one disputes TRW's assertion that none of the applicants qualifies as small, minority-owned or women-owned.[92] It therefore would appear that to disseminate Big LEO licenses to DEs we

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[88] Domestic Communications Satellite Facilities, 22 FCC 2d (1970), 35 FCC 2d 844 (1972), recon. in part, 38 FCC 2d 665 (1972) (DOMSAT I, II, and III, respectively).

[89] 47 U.S.C. § 309(j)(4)(c).

[90] See Notice, note 2, supra, at para. 43.

[91] See Implementation of Section 309(j), note 79, supra, at para. 74.

[92] See Docket 93-253 for criteria.

would have to open a new filing window for Big LEO applications.[93] While in some circumstances it might be feasible to take such an approach, we believe that it is not the case here. To ensure that this needed service is made available as quickly as possible, particularly to rural residents not otherwise served by the telecommunications infrastructure, and to preserve the opportunity for the United States to continue its leadership role in promoting global development through an enhanced global information infrastructure, we are committed to awarding licenses by January 31, 1995.[94] Opening a new filing window would make that goal impossible. Potential new applicants would need a reasonable amount of time, traditionally three months from the date of publication in the Federal Register, in which to develop and submit system proposals.[95] Opening a new filing window also would be inequitable to the pending applicants, who filed their proposals well before Section 309(j) was enacted and who have spent considerable time and expense participating in this proceeding. In light of these considerations, we believe that an auction to award Big LEO licenses is an appropriate exercise of our discretion.

81. Other considerations. In the Notice, we recognized that although auctions appear advantageous for many reasons, the approach might have unintended consequences internationally. In particular, we noted that other countries may look to our lead in imposing these costs on Big LEO systems.[96] Given the number of countries that may be served by Big LEO systems, we stated that these costs may be considerable and may preclude a U.S.-owned system from serving other countries. We noted, however, that these costs may not in fact be significant in countries that seek to ensure that voice MSS is available within its borders. We further noted that applicants will pay no more than that which they determine is consistent with their expected revenues from providing service in that country. Nevertheless, we recognized that the international nature of the Big LEO service raises concerns that are not applicable to the domestic-only services for which auctions are implemented and requested comment on this issue.

82. Motorola, Constellation, LQP, TRW, and COMSAT all contend that an auction is inadvisable because it would set a bad example for foreign governments. If foreign governments were to use auctions to assign spectrum rights, they maintain, the cost of providing global MSS would be driven up, possibly to such an extent that Big LEO operators would be unable to provide worldwide service. TRW asserts that the consequent cost increases might deter most potential entrants, to the impairment of competition, or might even make it infeasible for anyone to provide Big LEO service. COMSAT speculates that foreign governments might conduct auctions in a manner that places U.S. companies at a disadvantage.

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[93] DEs can, of course, participate in the Big LEO industry by leasing space segment capacity, by manufacturing user handsets, or by offering services to end users.

[94] See also note 6, supra.

[95] See NVNG MSS Order, note 48, supra. See also RDSS Licensing Order, note 37, supra, where licensee was given six months to amend its applications to conform to rules as adopted.

[96] Notice, note 2, supra, at para. 44.

83. The comments have provided no concrete evidence, however, that an auction would have these harmful effects. We have concluded elsewhere that, as a general matter, the public interest is served by awarding licenses to those who assign the highest value to them.[97] In light of these substantial public interest benefits, the commenters' mere recitals of the concerns we raised in the Notice do not persuade us that auctions are inadvisable.

84. We doubt, first, that our choice of licensing method for the Big LEO service will determine foreign licensing practices as much as the commenters predict. Foreign officials already know that we recently obtained a statutory mandate for assigning spectrum licenses by competitive bidding and have decided to assign licenses of enormous aggregate commercial value for a variety of new services by that means. We assume that those responsible for assigning spectrum rights in other countries will conduct spectrum auctions if that would best serve the interests that they are obliged to promote, regardless of what we choose to do in this proceeding. Further, even if auctions are implemented, applicants will bid no more at an auction than that which they determine is economically feasible.

85. Conversely, TRW contends that if we assign Big LEO licenses at auction and foreign authorities issue such licenses to others free of charge, the U.S. licensees would be at a competitive disadvantage in the global market. Constellation similarly maintains that by assigning the licenses at auction the Commission "would create an incentive for U.S. companies to develop LEO technology through foreign based systems that did not have to spend significant amounts of capital for operating licenses." TRW also contends that companies who purchase MSS licenses in the United States at auction might encounter unfair competition from INMARSAT because the INMARSAT Convention and the Communications Satellite Act might be construed to require that COMSAT be allowed to access INMARSAT capacity from the U.S. without paying for spectrum use.

86. We do not believe the prospect that auctions will be conducted only in the United States would disadvantage U.S. licensees globally. We have not yet decided whether, and the terms on which, foreign providers, including INMARSAT, will be able to provide domestic service. We envision that reciprocal bilateral arrangements on a country-by-country basis will be negotiated. In reaching and implementing these arrangements, we will consider at that time whether foreign entities not subject to U.S. auctions would have the economic incentive and ability to offer domestic service at significantly lower rates than Big LEO operators who purchased spectrum. Further, under this scenario, both U.S. operators and foreign operators appear able to receive licenses free of charge in a foreign country. We fail to see how this would put U.S. operators at a "global disadvantage." Finally, contrary to Constellation's argument, we see no reason to suppose that applicants who could compete successfully as providers of Big LEO service in the U.S. market would lose interest in developing systems in the United States merely because it would be necessary to purchase licenses. If it would be undesirable to serve

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[97] Implementation of 309(j), note 79, supra, at paras. 73-74 and n.65.

the U.S. market at high spectrum prices, the prices paid at an auction should fall until serving the U.S. market is commercially desirable.

87. Consequently, we conclude that we have the statutory authority to award Big LEO licenses through an auction process. We will implement competitive bidding procedures in the event that all six pending applicants file amendments on November 16, 1994 that meet all requirements, including financial requirements, for the Big LEO service, but their applications are still mutually exclusive.[98] We place applicants on notice that if an auction needs to be held it will be scheduled as quickly as possible. Given the importance of proceeding with Big LEO licensing, preparation time for the applicants will necessarily be circumscribed.

d. Competitive Bidding Procedures

88. Segmentation. As proposed in the Notice, we will divide the 1.6 GHz band spectrum into eight 2.0625 MHz segments.[99] We recognize that Constellation and LQP assert that a 2.0625 MHz block is "unworkable" because it is inconsistent with some of the applicants' channelization plans, which proposed 1.25 MHz channels. Further, LQP asserts that any auction of discrete bandwidth segments within the 1.6 GHz band would inevitably result in some applicants getting unusable, disjointed spectrum blocks. We do not believe these concerns warrant a change in the proposed spectrum blocks. First, two of the six applicants do not propose to use 1.25 MHz channels. Moreover, any anomalies in spectrum awards can be corrected in post-auction transactions, as we intend (as explained infra) to allow the licensees to aggregate and disaggregate spectrum through resale.

89. Bandwidth cap. To ensure that there are at least two Big LEO providers, we will not permit any applicant to acquire more than four 2.0625 MHz band segments in the 1.6 GHz band, i.e., no more than 8.25 MHz, at auction.[100] We would also deny permission for a post-auction transaction that would result in an accumulation in excess of that limit in the absence of a compelling showing of justification for a waiver.

90. Competitive Bidding Design. In determining the procedures to be employed if an auction of Big LEO licenses is necessary, we are guided by the principles developed in PP

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[98] If some applicants defer their financial showings as described in para. 13, supra, all deferred applications may not be able to be granted. If, at that time, we have issued some licenses, we will not implement the auction procedure described below, which assumes that none of the MSS spectrum has been assigned, to choose among the mutually exclusive deferred applications. Rather, as noted, we will develop another processing procedure at that time.

[99] As discussed in the Notice, it appeared that as little as 2.0 MHz of spectrum could provide an individual CDMA system with the same capacity as it would have operating on a shared basis over 11.35 MHz of spectrum. See Notice, note 2, supra, at para. 45.

[100] See Notice, note 2, supra, at para. 45.

Docket No. 93-253, the proceeding instituted to implement Section 309(j) of the Communications Act. The Second Report and Order in that proceeding[101] established the criteria to be used in selecting the auction design method to use for each particular auctionable service. The Commission received voluminous comment on auction design issues. Generally, we concluded that awarding licenses to those parties who value them most highly will foster Congress's policy objectives. In this regard, we noted that since a bidder's ability to introduce valuable new services and to deploy them quickly, intensively, and efficiently increases the value of a license to that bidder, an auction design that awards licenses to those bidders with the highest willingness to pay the most tends to promote the development and rapid deployment of new services and the efficient and intensive use of the spectrum. In articulating our auction design principles we agreed with the weight of the comments in that proceeding -- many of which were supported by academic auction design experts -- that: (1) licenses with strong value interdependencies should be auctioned simultaneously; (2) multiple round auctions generally will yield more efficient allocations of licenses and higher revenues, especially where there is substantial uncertainty as to value because they provide bidders with information regarding other bidders' valuations of licenses; and (3) since they may be relatively expensive to implement and time-consuming, simultaneous and/or multiple round auctions may become less cost-effective as the value of licenses decreases.[102]

91. Based on the foregoing, we concluded that where the licenses to be auctioned are interdependent and their value is expected to be high, simultaneous multiple round auctions would best achieve the Commission's goals for competitive bidding.[103] We indicated that compared with other bidding mechanisms (such as sequential and sealed bid auctions), simultaneous multiple round bidding will generate the most information about license values during the course of the auction and provide bidders with the most flexibility to pursue back-up strategies. Thus, we concluded that simultaneous multiple round bidding is most likely to award interdependent licenses to the bidders who value them most highly. We also indicated that this method will facilitate efficient aggregation of licenses across spectrum bands, thereby resulting in vigorous competition among several strong service providers who will be able rapidly to introduce a wide variety of services highly valued by end users.[104] In addition, we concluded that because of the superior information and flexibility it provides, this method is likely to yield greater revenues than other auction designs. Thus, we found that the use of simultaneous multiple round auctions would generally be preferred.[105]

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[101] Note 79, supra.

[102] Id. at para. 69.

[103] Id. at paras. 109-111.

[104] Id. at para. 106.

[105] Id.

92. Because, however, simultaneous multiple round bidding is likely to be more administratively complex and costly both for bidders and for the FCC than sequential or single round bidding, we indicated that we would use this auction design only where license values are interdependent and the expected value of the licenses to be auctioned is high relative to the costs of conducting a simultaneous multiple round auction.[106]

93. If it becomes necessary to employ competitive bidding procedures to award Big LEO licenses, we will conduct a single simultaneous multiple round auction to award licenses in those 2.065 MHz bands for which two or more applications have been filed.[107] Each of the characteristics that lead to selection of this auction design are present here. We expect that there will be a high degree of interdependence in the values of Big LEO licenses. Licenses may be interdependent either because they are substitutes or because they are worth more as part of a package than individually. We would expect there to be some substitutability among these licenses. There may be important ways in which they might be complements as well. Though all will be nationwide licenses, a single entity will be able to aggregate up to four licenses. It is reasonable to assume that the value that a bidder places on one license will to at least some degree depend upon whether it will be able to acquire other licenses. We also expect that the value of Big LEO licenses will be high relative to the costs of conducting a simultaneous multiple round auction, in part because as the Commission gains experience with simultaneous multiple round auctions, the costs associated with of implementing them may fall.

94. Procedural, Payment and Penalty Issues. Through our July 1994 auction of nationwide licenses to provide Personal Communications Services in the 900 MHz band (narrowband PCS), we have gained some experience with simultaneous multiple round auctions. It appears that the rules we adopted concerning the procedures to be used in conducting auctions, the schedule for payment for licenses, and the penalties to be paid for bid withdrawal, default or disqualification, have worked well.[108] In the event that it becomes necessary to employ competitive bidding in Big LEO licensing, we will conduct auctions as specified under those rules. If such an auction is required, we will issue a Public Notice explaining further the administrative details of the auction, but we generally expect the auction will be conducted similarly to the nationwide narrowband PCS auction.

95. In order to reduce the risk of defaults and to ensure that the Commission has a ready source of funds to satisfy any bid withdrawal or default penalties, we will impose a requirement that, to be qualified to participate in the Big LEO auction, applicants must submit

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[106] Id. at paras. 110-111.

[107] See para. 73, supra.

[108] See Sections 1.2104-1.2109 of the Commission's Rules, 47 C.F.R. §§1.2104-1.2109.

an upfront payment to the Commission prior to the auction.[109] Consistent with our auction rules for Personal Communications Services, we have decided to set the upfront payment at approximately two cents per MHz of spectrum per person residing in the proposed service area ($0.02 per MHz-pop).[110] Because Big LEO systems must be able to provide service to all areas of the fifty states, $0.02 per MHz-pop would amount to approximately $10 million per 2.0625 MHz segment.[111] For simplicity, we will round this to the nearest million, and require an upfront payment of $10 million.

96. Resale, aggregation and disaggregation. Aside from imposing the 8.25 MHz cap on aggregation, we will not restrict auction winners from reselling 1.6 GHz band spectrum-rights. They would be free not only to resell 2.065 MHz segments but also to reassign any smaller portion of 1.6 GHz band spectrum. Affording such flexibility enhances beneficial incentives.[112] Although we do not think that such post-auction transactions would be likely to entail unjust enrichment,[113] applications for consent to assignment of Big LEO spectrum authorizations obtained by auction will be subject to the disclosure and close-scrutiny policies delineated in the Second Report and Order in the auction rulemaking.[114]

97. Assignment of 2.4 GHz band. As previously noted, all auction winners will be authorized to operate over the entire 2483.5-2500 MHz band, with the stipulation that operation in that band must be in the CDMA mode and must be used for downlink transmissions.

## B. Interservice Sharing

98. In the Notice, we recognized that Big LEO systems will be required to share the 1.6/2.4 GHz and adjacent frequency bands with a number of existing services. In the 1.6 GHz range, the 1610-1626.5 MHz band is allocated to the aeronautical radionavigation service (ARNS) on a co-primary basis, and a segment of the band, at 1610.6-1613.8 MHz, is allocated to the radioastronomy service (RAS) on a co-primary basis. In the 2.4 GHz range, the 2483.5-2500 MHz band is allocated for co-primary use by the broadcast auxiliary service, by the terrestrial

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[109] The upfront payment will be fully refunded to unsuccessful bidders who are not subject to bid withdrawal or default penalties.

[110] See Implementation of Section 309(j), note 79, supra, at para. 169 and 47 C.F.R. § 1.2106.

[111] I.e., .02 x 2.0625 x [U.S. pop.]

[112] Of course, parties to such transactions must comply with 47 U.S.C. § 310(d) by filing applications for consent to assignment.

[113] See Implementation of Section 309(j), note 79, supra, at paras. 211-12.

[114] Id. at para. 214.

fixed-service and by industrial, scientific and medical (ISM) operations. Adjacent bands are allocated to the aeronautical radionavigation satellite service, the instructional television fixed service (ITFS) and the multi-channel multi-point distribution service (MMDS).

99. The Negotiated Rulemaking Committee was comprised of Big LEO applicants and representatives of most parties potentially affected by Big LEO services, and analyzed extensively interservice sharing at 1.6/2.4 GHz. We used the Committee's recommendations as the primary basis the proposals in our Notice. We sought comment on those proposals as well as on those areas where a representative of an affected interest did not participate in the Committee, or where the Committee could not reach a consensus on an interservice sharing issue.

1. Radio Astronomy Service

100. As noted above, the 1610.6-1613.8 MHz frequency band is allocated to the RAS on a co-primary basis.[115] RAS operations involve the reception of radio waves of cosmic origin,[116] and are responsible for amassing a substantial portion of information about the universe that has been acquired in the last sixty years. Because the RAS involves only radio reception, it cannot interfere with other services operating in the same frequency band. However, it can receive harmful interference from other services. As a co-primary service, the RAS is entitled to protection from harmful interference. Ensuring this protection is complicated by the nature of cosmic radiation emissions, which are similar to random noise emissions and have extremely low power flux density levels at the Earth. Further, there is a potential for both in-band and out-of-band interference.[117]

a. In-band interference to the RAS

101. The Committee was able to agree on procedures that would permit sharing between Big LEOs and the RAS. The Committee's task was made somewhat easier by the fact that radio astronomy observations are usually conducted in remote areas and are not always continuous. The Committee's proposal, developed cooperatively with the Committee on Radio Frequencies

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[115] The 4990-5000 MHz band is also allocated to the RAS on a primary basis. Second harmonic spurious emissions from 2.4 GHz MSS operations could cause interference to RAS in that band. See paras. 120-121, infra.

[116] See international Radio Regulations 55 and 14.

[117] An out-of-band emission is radio frequency energy, located on a frequency or frequencies immediately outside the necessary bandwidth, that result from the modulation process. This does not include spurious emissions, which may be reduced without affecting the corresponding transmission of information. See 47 C.F.R. § 2.1.

(CORF),[118] would establish fixed-radius protection zones around the sixteen radio astronomy sites in the United States and technical requirements for MSS downlink transmissions. Based on this recommendation, we proposed to establish protection zones around radio astronomy sites in the United States as a means of preventing MSS transmissions from interfering with RAS observations in the 1610.6-1613.8 MHz band.[119] To that end, we also proposed that "all 1.6/2.4 GHz MSS systems shall be capable of determining the position of MSS user transceivers accessing the space segment through either internal radiodetermination calculations or external sources such as LORAN-C or GPS." [120]

102. Big LEO parties generally agree with the fixed-radius protection zone approach. However, both TRW and Constellation question whether it is necessary to require all MSS systems to be capable of determining the position of their user terminals.[121] They contend that a position location requirement need not be imposed on those MSS systems that elect to use beacon-actuated protection systems as a means for avoiding harmful interference to RAS observations.

103. As we stated in the Notice, the Committee decided that a beacon actuated protection system might provide an alternative to fixed radius protection zones. Under such a system, a beacon would transmit a signal when RAS observations were in progress. Upon receipt of this signal, an MSS control center would automatically assign the MSS terminal to a communications channel outside of the shared MSS-RAS frequency band. The Committee concluded, however, that several theoretical and practical concerns must be addressed before a beacon system can be implemented.[122] CORF continues to support that position.[123]

104. Because beacon actuated protection systems are not yet fully developed, we will adopt our original proposal that requires MSS operators to protect RAS observations in the 1610.6-1613.8 MHz band using the fixed-radius protection zone method. Nevertheless, because we expect that more efficient solutions will be developed, we will permit MSS licensees to use smaller geographic protection zones in lieu of the specified areas upon a showing that MSS operations will not cause harmful interference to an RAS observatory during periods of

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[118] CORF operates under the auspices of the National Academy of Sciences and is responsible for advancing the interest of radio astronomy in the United States.

[119] See proposed Section 25.213(a)(1)(i)-(iii).

[120] See proposed Section 25.213(a)(1).

[121] TRW Comments at 120, Constellation Reply at 43.

[122] Notice, note 2, supra, at n.90.

[123] CORF Reply Comments at 4.

observation.[124] We will, however, as proposed, allow beacon-actuated protection zones to be used in lieu of fixed protection zones if a coordination agreement is reached between a mobile-satellite system licensee and the Electromagnetic Spectrum Management Unit (ESMU) on the specifics of beacon operations."[125] Should any of the Big LEO licensees show at a later time, and coordinate with the ESMU, that certain other methods can be used in lieu of the fixed-radius protection zone, we will allow MSS system operators to employ these methods. In the interim, however, position determination of MSS user transceivers is necessary to accomplish fixed-radius zone protection. Therefore, we adopt as part of Section 25.213(a)(1), the MSS user transceiver position determination requirement as proposed in the Notice.

105. In the Notice, we also proposed that MSS user transceivers be capable of terminating operations as soon as practicable upon entering an RAS protection zone.[126] LQP argues that our proposal would require that calls initiated outside of an RAS protection zone be terminated as soon as the MSS user transceiver moves within the protection zone, which, according to LQP, would be inordinately complex and costly.[127] LQP suggests that our rules should permit the call to be switched successfully to frequencies outside of the RAS bands (during RAS observations) before operations are terminated to that unit.[128]

106. We believe that LQP's suggestion is reasonable. Allowing calls initiated prior to entering an RAS protection zone to continue until a non-RAS frequency is found will ensure continuity of service to the MSS user. Further, we believe that other requirements that we are adopting, such as the notification requirement that is described below, will ensure that RAS operations are not affected adversely. Therefore, we modify proposed Section 25.213(a)(1)(v) as suggested by LQP.

107. We also proposed in the Notice to require that the ESMU notify MSS licensees in the 1610.6-1613.8 MHz band of radio astronomy observations.[129] This requirement was proposed to ensure that MSS operations terminate as soon as possible after an MSS user transceiver enters a RAS protection zone where observations are being made. CORF suggests that it could meet this requirement by providing MSS operators with schedules of RAS

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[124] See Section 25.213(a)(1)(v).

[125] See Section 25.213(a)(1)(vii). The ESMU falls under the auspices of the National Science Foundation and is responsible for coordinating RAS frequencies.

[126] See proposed Section 25.213(a)(1)(v). Notice, note 2, supra, at para. 50.

[127] LQP Reply at 58.

[128] LQP Comments at 64.

[129] See proposed Section 25.213(a)(1)(v).

observations.[130] TRW disagrees, stating that CORF should be required to provide notification "of periods of actual radio astronomy observations rather than a general schedule."[131] We agree with TRW that it would not be overly burdensome for the ESMU to notify the small number of licensed in-band Big LEO operators of periods of actual RAS observations. This will help ensure that no interference is caused to RAS observations in the event that a schedule is changed.

108. In a related matter, Motorola notes that the Committee suggested that RAS observations not be scheduled during peak MSS/RDSS traffic periods to the extent possible.[132] CORF does not object to this proposal.[133] RAS observations are usually carried out in remote areas and are not continuous. Even during peak MSS traffic periods, the majority of MSS traffic should not occur in RAS observation areas. We do not therefore believe that adherence to this provision will be burdensome to RAS. Consequently, we include this provision in our rules in Section 25.213(a)(4).

109. Finally, TRW requests that we agree to solicit public comment before we require MSS systems to protect additional RAS sites beyond the sixteen sites specified in the rules.[134] In bands shared by two or more services on a co-primary basis, new facilities in either service must be coordinated among affected operators. As provided for in proposed rule Section 25.213(1)(a)(viii), which we adopt, we will solicit comment with respect to protection from additional RAS sites.

b. Out-of-band interference to RAS from primary MSS uplinks at 1.6 GHz

110. In the Notice, we also recognized that MSS uplink operations in the 1613.8-1626.5 MHz portion of the band could cause unacceptable out-of-band interference into RAS operations at 1610.6-1613.8 MHz. We also noted the Committee's suggestion to establish fixed protection zones similar to, but smaller than, those recommended for in-band emissions, although we did not propose a rule in this regard.[135]

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[130] CORF Comments at 4-5.

[131] TRW Reply Comments at 72.

[132] Motorola Comments at 55, n. 41.

[133] Specifically, CORF supports insertion of the following text in the rules: "The RAS shall avoid scheduling radio astronomy observations during peak MSS/RDSS traffic periods to the greatest extent practicable." See CORF Reply at 2.

[134] Proposed Section 25.213(a)(1)(vii).

[135] Notice, note 2, supra, at para. 51.

111. CORF suggested several alternatives to our proposals:[136]

(1) to require that the power flux density (pfd) level reaching RAS sites from a mobile user terminal operating anywhere in the 1610-1626.5 MHz band not exceed the pfd from a mobile user terminal operating within the RAS 1610.6-1613.8 MHz band segment at the edge of the protection zone applicable for that site, or

(2) to prohibit mobile terminal operations within the 1613.8-1615.8 MHz band during RAS observations within protection zones of 100 km or 30 km around RAS sites depending upon the type of observatory involved. [137]

112. The MSS parties generally oppose restrictions on out-of-band emissions for the purpose of protecting RAS. For example, Constellation argues that MSS out-of-band levels should not be unilaterally defined by the radio astronomy community without any regard to the impact those levels would have on other services.[138] TRW states that it could agree to CORF's suggestions if a compliant mobile user terminal were not required to undertake further coordination with the RAS. TRW notes, however, that CORF's out-of-band protection proposals would relegate MSS to co-primary or even lower status in frequency bands that are not allocated to the RAS."[139] Only LQP generally agrees with CORF's suggestion. According to LQP, there is sufficient 1.6 GHz band spectrum to switch MSS users near RAS sites from potentially interfering channels to channels separated from RAS observations.[140]

113. We have considered the impact of this proposal on Big LEO licensees and conclude they would not be unduly burdened by protecting RAS observations from out-of-band MSS emissions. It appears that less than one percent of the MSS consumer use would be affected by CORF's alternative proposals for protecting RAS from out-of-band MSS emissions.[141]

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[136] See CORF Comments at 3-4.

[137] Radio astronomy observatories use two types of antennas. Observatories with a very long baseline array (VLBA) use interconnected radio telescopes that are dispersed in widely separated locations. Due to the geographic separation of the telescopes, the chance of correlated interference from any single mobile earth terminal is small. Consequently, VLBA sites are not as susceptible to interference as are observatories using a single radio telescope. Eleven of the 16 radio astronomy sites in the U.S. are VLBA sites and they require relatively smaller protection zones than non-VLBA sites.

[138] Constellation Comments at 47.

[139] TRW Reply at 71.

[140] LQP Reply Comments at 57, Reply Tech Appendix at 2.1.

[141] CORF Reply Comments at 8.

Further, those affected would not be denied communications. They would simply be assigned to another uplink channel by the MSS network control center. We do not believe that the CORF proposals relegate the MSS to co-primary or even lower status. The RAS is seeking protection in bands only in the 1610.6-1613.8 MHz band, which is allocated to the RAS. Therefore we adopt CORF's proposals to protect RAS, during observations, from out-of-band emissions caused by Big LEO systems. If Big LEO operators cannot meet the power density levels necessary to protect RAS from harmful interference, we will require that Big LEO operations be terminated within the protection zones specified in Section 25.213(a)(1)(iii).

c. Out-of-band interference to RAS from secondary downlinks in the 1.6 GHz band

114. In the Notice, we proposed to codify the Committee's recommendations to eliminate potential harmful out-of-band interference to RAS from secondary MSS downlinks operating at 1613.8-1626.5 MHz.[142] The Committee recommended that such operations be restricted to frequencies separated by the upper edge of the RAS band by at least 2.2 MHz, that MSS downlink emissions be filtered aboard the spacecraft, that frequencies be selectively controlled and that an analysis and testing program be conducted in cooperation with the radio astronomy community. Based on its deliberations, the Committee proposed that we adopt rules governing use of the 1613.8-1626.5 MHz band that limit out-of-band emissions so that they do not exceed -238 dB(W/m$^2$/Hz) during observations at non-VLBA sites and -198 dB(W/m$^2$/Hz) during observations at VLBA sites.

115. Motorola argues that the limits proposed in the Notice are too rigid and would unduly constrain MSS operations.[143] In support, Motorola contends that those limits were devised originally using assumptions that are not applicable to Big LEO operations. For example, Motorola notes that the calculations assumed an immobile, continuous interference source, whereas secondary MSS downlink LEO operations would present an intermittent source. Further, Motorola notes that although the Committee reached a consensus on a recommendation regarding limits, it did not agree on a proposed rule to govern Big LEO MSS operations. Motorola asserts that instead of adopting specific protection limits applicable to MSS secondary downlinks, the Commission should only restate the general obligation that secondary services not cause harmful interference to primary services.

116. LQP and TRW disagree with Motorola. LQP states that our proposal is reasonable and should be adopted.[144] TRW asserts that Motorola's proposal does not adequately consider the needs of the RAS. It states, however, that if secondary downlinks are limited to the

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[142] Notice, supra note 2, at para. 51; see also proposed Section 25.213(a)(2).

[143] Motorola Comments at 54.

[144] LQP Reply at 59-60.

1621.35-1626.5 MHz band, thereby creating a 7.5 MHz guardband between RAS and secondary MSS, Motorola's proposals would be acceptable.[145]

117. We recognize the need to protect RAS observations from secondary MSS downlink operations. At this juncture, however, we need not consider specific limits on Big LEO MSS secondary downlinks. Secondary services by definition shall not cause harmful interference nor claim protection from primary services.[146] This provision applies to protection of primary services from both in-band and out-of-band emissions and would apply to secondary MSS downlinks regardless of specified pfd levels. Thus, we see no reason to codify specific pfd limits as proposed in the Notice. We will instead modify proposed Section 25.213(a)(2) to note that secondary MSS downlinks shall not cause harmful interference to primary RAS operations in the 1610.6-1613.8 MHz band. Further, operators of secondary downlinks will be required to take whatever steps necessary to resolve interference complaints by radio astronomers. We expect that an applicant proposing to operate MSS downlinks in the 1613.8 - 1626.5 MHz band will be able to demonstrate in its application that it has sufficient satellite out-of-band emission attenuation to protect adjacent band U.S. RAS operations based upon the frequency separation inherent in the frequency assignment scheme adopted here.

118. Finally, Cornell University, Arecibo Observatory, notes its concern that MSS downlink transmissions at 1.6 GHz could have a "disastrous effect" on passive space research in the 1610-1667 MHz band.[147] LQP, in support of Cornell, notes that the Commission must limit MSS downlink transmissions to the 5.15 MHz proposed in the Commission's Notice, that is, to 1621.35-1626.5 MHz.[148] Motorola responds that "the 1613.8-1660 MHz band is not allocated to the RAS on a primary or secondary basis" and thus is not entitled to protection from secondary MSS downlinks operating outside that band.[149]

119. There is no RAS allocation in the 1613.8-1660 MHz band and the service is therefore not entitled to protection in these bands Consequently, we will not limit MSS transmissions in order to protect RAS as suggested by Cornell University and LQP. In any case, we do not believe that RAS observations above 1634 MHz would be affected by secondary MSS downlinks in the 1621.35-1626.50 MHz band given the frequency separation.

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[145] TRW Reply Comments at 74.

[146] See note 21, supra.

[147] Cornell Comments at 3-5. The 1610-1667 MHz band is being used passively, without any allocation, by radio astronomers to observe red-shifted Hydroxyl (OH) emissions.

[148] LQP Reply Comments at 59.

[149] Motorola Reply Comments at 49

d. Spurious emissions into the 4990-5000 MHz from primary downlinks in the 2483.5-2500 MHz band

120. The Committee recognized that second harmonic spurious emissions from primary MSS downlink transmissions in the 2483.5-2500 MHz band could cause unacceptable interference to RAS operations in the 4990-5000 MHz band. It concluded and we proposed in Section 25.213(a)(3) that MSS downlink out-of-band spectral power flux density (spfd) levels should be limited to -241 dB(W/m$^2$/Hz) in the 4990-5000 MHz band.

121. We will adopt the rules as proposed. Although Constellation argues that it opposes any such codification of the radio astronomy community's definition of "unacceptable" interference,[150] we note that Constellation participated in the Committee and its deliberations and agreed to the Committee's Report that included this recommendation. More importantly, as stated in the Notice, we believe that these limits can be readily met through proper amplifier device selection and operating conditions in combination with post-amplifier filtering.

2. Aeronautical Radionavigation Satellite Service and Radionavigation-Satellite Service

122. The U.S. Global Positioning System (GPS) can operate under the radionavigation-satellite (space-to-Earth) service (RNSS) allocation in the 1565.2-1585.6 MHz band. GPS is a space-based positioning, velocity, and time system whose space segment, when fully operational, will be composed of 21 operational satellites in six orbital planes. GLONASS, the Russian Global Navigation Satellite System, can operate under the same service allocation in the 1597-1610 MHz bands.[151] Additionally, GLONASS can operate under the aeronautical radionavigation service (ARNS) allocation in the 1610-1616 MHz band pursuant to RR 732 of the international Radio Regulations.[152] The GLONASS system will include 24 operational satellites in three orbital planes. The user segment of both the GPS and GLONASS systems will consist of antennas and receiver-processors that can receive both GPS and GLONASS signals to provide positioning, velocity, and precise timing to the user. The Committee addressed ARNS/RNSS - MSS sharing and developed specific recommendations in that regard. We based the sharing proposals in the Notice on the Committee's recommendations and on requirements embodied in the International Radio Regulations.

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[150] Constellation Comments at 48.

[151] See Notice, note 2, supra, at para. 53.

[152] RR 732 reserves the 1610-1626.5 MHz band on a worldwide basis for the use and development of air navigation and directly associated terrestrial or satellite based facilities. It also provides that any satellite use of the band is subject to agreement under the procedures of Article 14 of the International Radio Regulations. Pursuant to the international Radio Regulations, MSS stations may not cause harmful interference to or claim protection from stations operating in accordance with RR 731E.

a. In-band interference to ARNS from MSS uplinks in the 1610-1626.5 MHz band

123. Pursuant to international Radio Regulations, MSS stations may not cause harmful interference to or claim protection from stations operating under RR 732. Further, international Radio Regulation RR 731F provides that MSS earth stations operating with MSS space stations cannot radiate an equivalent isotropically radiated power (e.i.r.p.) density greater than -15 dB(W/4KHz) in that portion of the band used by systems operating in accordance with RR 732, and -3 dB(W/4KHz) in bands not so used.

124. The Committee concluded that GLONASS receivers operating on-board high altitude aircraft could be protected against interference from MSS operations operating in accordance with RR 731E.[153] It also concluded that protection would not be possible if GLONASS is used for aircraft approach and terminal communications, as is contemplated by the FAA.[154] The Committee recommended and we proposed in Section 25.213(c)(1) to codify the uplink e.i.r.p. limits contained in RR 731E. The Committee had stated that this limit is needed to allow the proposed Big LEO systems to be implemented, although it acknowledged that it will not protect GLONASS if GLONASS is used to provide aircraft approach and terminal communications as a component of a "sole means" GNSS. The Committee also examined several methods to improve the ARNS/RNSS - MSS sharing environment. One was to reconfigure GLONASS so that it would operate only on frequencies below 1610 MHz.[155] Another method

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[153] The Committee analyzed the potential levels of interference from a typical CDMA mobile unit to a GPS/GLONASS receiver. It concluded that MSS units would not interfere with enroute GLONASS navigation at altitudes in excess of 10,000 meters (Committee Report, note 23, supra, at 3.3.4.3). However, aviation parties participating in the Committee stated that the analysis was inadequate to demonstrate interference compatibility at a 95 percent confidence level.

[154] See para. 49, supra. For a further discussion of the disparity between ARNS protection requirements and MSS user terminal e.i.r.p. requirements, see Committee Report, note 23, supra at 18-21.

[155] The Committee offered two possible methods for limiting GLONASS operations to frequencies below 1610 MHz. One would be to reconfigure the GLONASS frequency plan. Currently, the plan is for a total of 24 GLONASS satellites to operate using 24 discrete downlink carrier frequencies. However, GLONASS satellites currently under construction have the ability to operate on any of the 24 frequencies distributed between 1602 and 1615.5 MHz. This frequency agility could allow antipodal satellites (those above opposite areas of the earth) to operate using the same frequencies. Thus, the entire system could operate using 12 frequencies below 1610 MHz. The other method would be to shift all 24 GLONASS frequencies to spectrum below 1610 MHz. The Committee noted, however, that this more radical approach might require redesign of the GLONASS system. In any event, both the aviation community and the Big LEO community have indicated that they fully expect GLONASS to shift to frequencies below 1610 MHz at some point. The recent bilateral coordination meetings with the Russian Federation have confirmed that the GLONASS system will shift its frequencies to below 1606 by 2005 or sooner.

for improving sharing possibilities, it noted, would be to modify GLONASS receiver standards to reduce vulnerability to interference from in-band MSS. Alternatively, it suggested that the U.S. GPS be enhanced to lessen or eliminate reliance on GLONASS altogether. Further, the Committee recommended, and we proposed in Section 25.213(c)(2), that to protect operations of GLONASS receivers on-board aircraft, MSS terminals should be prohibited from being used on civil aircraft.

125. Aeronautical Radio, Inc., and the Air Transport Association of America (ARINC/ATA), Rockwell International Corporation (Rockwell), and the FAA argue that both GLONASS and GPS operations, as potential components of the GNSS, must be protected during all phases of flight over the United States. To that end, they proffer additional limitations on Big LEO operations. ARINC/ATA argues that the Commission should clarify that the RR 731E limitation of -15 dB (W/4kHz) for MSS mobile terminals should apply only after GLONASS moves to frequencies below 1610 MHz. Until then, they contend, the limit should be -78.5 dB (W/MHz).[156] Similarly, Rockwell states that the RR 731E limit is insufficient for protecting GLONASS operations at 1610-1616 MHz. Rockwell claims that the RR 731E power density level is about 140 dB above the maximum interference level that can be tolerated by a typical GLONASS receiving system. Rockwell asserts that shared use of this band segment is impractical absent significant constraints on either MSS or GLONASS. Therefore, it maintains that MSS operation should not be permitted in the 1610-1616 MHz band segment until GLONASS operations are shifted to frequencies below 1610 MHz.[157] The FAA states that the Commission indicated that use of the 1610-1616 MHz band by MSS is premised upon moving GLONASS below 1610 MHz. It maintains that the e.i.r.p. density specified in RR 731E is too high to protect in-band GLONASS for anything but high altitude enroute communications.[158]

126. Several of the MSS applicants also disagree that more restrictive limits should be placed on MSS uplinks pending a GLONASS frequency shift. Constellation states that more realistic interference criteria and models must be developed before any requirements other than the RR 731E uplink e.i.r.p density limit can be adopted.[159] Ellipsat contends that no additional requirements should be adopted because the aviation community has not provided a legitimate basis for overly stringent requirements on MSS uplinks. Further, Ellipsat maintains that even if GLONASS becomes a component of the GNSS, the aviation community has not provided a showing that GNSS performance would be impaired if degradation were to occur to the small number of GLONASS satellites that would operate above 1610 MHz.[160] Motorola claims that

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[156] ARINC/ATA Comments at 2-3.

[157] Rockwell Comments at 2-3.

[158] FAA Comments at 2.

[159] Constellation Reply Comments at 47.

[160] Ellipsat Reply at 11.

the proposed limits advocated by the aviation community are based on flawed assumptions and unsound analysis. Additionally, Motorola asserts that the protection the aviation parties claim as necessary is based on the erroneous assumption that corrupting a single measurement from a GLONASS satellite will cause unacceptable degradation in the ability to navigate.[161]

127. Several MSS applicants also state that, to afford new MSS systems flexibility in how they protect ARNS/RNSS, the Commission should modify proposed rule Section 25.213(c)(1), which, in addition to the uplink limits contained in RR 731F, requires all MSS operations in the 1.6 GHz band to be coordinated with systems operating pursuant to RR 732. Motorola argues that rules embodied in the international Radio Regulations are adequate for ensuring coordination with and protection of other services.[162] Constellation contends that footnote RR 731E establishes the only enforceable interference criteria (i.e., a maximum e.i.r.p. density of -15 dB (W/4kHz) from MSS transmitters) that can be incorporated into the Commission's rules at this time. Motorola, in contrast, suggests that the e.i.r.p value set forth in Section 25.213(c)(1) be interpreted as a coordination trigger rather than an absolute limit.[163] LQP states that the proposed rule requires MSS systems to protect GLONASS beyond the limits specified in RR 731E.[164]

128. We do not believe it is necessary to protect GLONASS operations beyond the provisions of RR 731E and the obligation to coordinate MSS systems under current International Telecommunications Union (ITU) procedures. RR 731E states clearly that MSS stations shall not cause interference to, nor claim protection from ARNS stations operating in accordance with RR 732. In addition, under ITU Resolution 46, Big LEO licensees would be subject to whatever limits or conditions agreed upon during the coordination process. GLONASS would likely be part of the coordination negotiations. Accordingly, we reject the aviation community's requests that additional limits be placed on MSS operations pending a GLONASS move, particularly absent definitive technical characteristics and requirements of a future GNSS system, and a

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[161] Motorola Reply Comments at 51. Motorola notes that a study conducted for LQP by Sat-Tech Systems demonstrates that loss of a single satellite will never cause a loss of GNSS (LQP Comments at Technical Appendix, para. 2.2.1 at 12). In addition, the Committee performed an analysis of the availability of GNSS satellites if the GLONASS constellation operated only on frequencies below 1610 MHz. It concluded that a minimum of five satellites would always be available for GNSS. In addition, it noted that this minimum would occur for only 14 minutes in every 51-day period. It noted further that since only four GNSS satellites are required for navigation and an additional one satellite to for system integrity, it appeared that GLONASS satellites operating above 1610 MHz might not be required for either navigation or terminal approach communications. Committee Report, note 23, supra at 3.3.4.4.

[162] Motorola Reply Comments at 47.

[163] Motorola Comments at 55.

[164] LQP Comments at 66-67.

definitive statement as to GLONASS's role in the GNSS.[165] Further, imposing additional constraints on Big LEO use of the 1610-1616 MHz band could jeopardize the applicants' ability to implement their systems. This could deprive the United States and those countries who choose to participate in offering services the potential benefits that Big LEOs could bring. Conversely, we do not believe the limits in RR 731E should be relaxed, as Motorola suggests. It is clear -15 dB(W/4kHz) is a limit and not a threshold for coordination. Therefore, we adopt the e.i.r.p. limits embodied in RR 731E in Section 25.213(c)(1) with the requirement that coordination of MSS mobile earth terminals must be undertaken according to the provisions of Resolution 46 (WARC-92).

129. We also adopt our proposed rule that prohibits operation of Big LEO terminals on-board civil aircraft unless the terminal has a direct connection to the aircraft's Cabin Communication System. However, we agree with Constellation and others that this a transceiver operating provision and is not necessarily a sharing requirement. Therefore, since this provision is contained in § 25.136(a) of our rules, it need not be repeated in § 25.213. Consequently, we do not adopt proposed rule § 25.213(c)(2) and refer licensees to § 25.136(a).

b. Out-of-band interference to ARNS/RNSS in the 1559-1610 MHz band

130. Protection of GPS from out-of-band emissions from primary uplinks in the 1610-1626.5 MHz band. The Committee concluded that out-of-band emissions by MSS uplinks in the 1610-1626.5 MHz band could potentially interfere with GPS operations near 1575 MHz. The Committee found, however, that sharing is possible if appropriate limits are put on out-of-band emissions from MSS user transceivers.[166] The Committee recommended, and we proposed, that MSS user transceivers limit out-of-band emissions (for broadband noise emissions) so as not to exceed an e.i.r.p. density of -70 dBW/1MHz averaged over any 20 millisecond (ms) period in any portion of the 1574.397-1576.443 MHz band. For any discrete spurious emissions in the same band (i.e., bandwidth less than 600 Hz), the user transceiver e.i.r.p density is not to exceed -80 dbW.[167]

131. ARINC/ATA agrees that the proposed limits will protect GPS.[168] The FAA, however, recommended that the protection bandwidth for GPS "be established at least 20 MHz

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[165] LQP notes that the FAA has suggested that it is still studying how GLONASS "best fits" a GNSS. LQP Reply at 62.

[166] See Committee Report, note 23, supra, at para. 5.2.2.7

[167] See proposed Section 25.213(b)

[168] See ARINC/ATA Comments at 3

wide, (i.e., 1575.42 +/- 10 MHz)."[169] No technical analysis was provided to support this recommendation.

132. TRW, Ellipsat, and LQP contend that the proposed out-of-band emission limits should be relaxed.[170] They contend that relaxing the limits will allow for reasonably priced user terminals and will adequately protect GPS from out-of-band emissions from these terminals. Constellation, in contrast, supports the proposed limits. It states that the protection level for GPS receivers is reasonable given the frequency separation between the lower end of the MSS band at 1610 MHz and GPS signals at 1575.42 MHz.[171]

133. We believe that the proposed out-of-band emission limits for MSS user transceiver operations in the 1610-1626.5 MHz band are appropriate to protect GPS operations near 1575 MHz. Both the aviation and MSS parties participated in the Committee's deliberations that resulted in a consensus on an out-of-band emission limit for protecting GPS. No party has demonstrated that a modification of those limits is now warranted. The MSS parties do not demonstrate that the limits are overly restrictive or that significant additional costs would be incurred by building transceivers to meet the limits. Similarly, the aviation parties have not shown that additional protection bandwidth for GPS is necessary. We therefore adopt proposed Section 25.213(b) with minor editorial changes.

134. Protection of GLONASS from out-of-band emissions from primary uplinks in the 1610-1626.5 MHz band. The Committee also addressed potential MSS out-of-band interference to GLONASS operations below 1610 MHz, but did not reach a consensus. It did, however, suggest a methodology that could be used to determine appropriate limits. It also noted that there was general agreement that the MSS user transceiver out-of-band emission limits recommended for protecting GPS would be sufficient to protect GLONASS operations below 1610 MHz.[172] We requested comment on the proposed methodology and on the appropriate parameters to be used in developing protection criteria.

135. ARINC/ATA and Rockwell maintain that the MSS out-of-band emission limits appropriate for protecting GPS operations near 1575 MHz should similarly apply to GLONASS operations below 1610 MHz.[173] The FAA suggests an interference threshold of -145 dBW/1MHz

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[169] See FAA Comments at 3.

[170] LQP suggested that the limit be -50 dBW/1MHz averaged over any 20 ms period in any portion of the 1575.42 +/- 1.023 MHz band for broadband noise emissions. LQP Comments at 65. See also TRW Reply at 77 (n. 118), Ellipsat Reply at 11 (n.7)

[171] Constellation Comments at 49.

[172] See Committee Report, note 23, supra, at para. 5.2.2.7

[173] See ARINC and ATA Comments at 3 and Reply at 7; Rockwell Comments at 4.

for GLONASS receivers operating below 1610 MHz and calculates a -71 dBW/1MHz MSS user terminal out-of-band emission limit which, it argues, is necessary to protect GLONASS operations at that particular interference threshold. [174]

136. The MSS applicants question whether the assumptions made by the aviation parties in their analyses are appropriate and disagree that a direct correlation can be made between the out-of-band emission limits necessary for protecting GPS and the limits necessary for protecting GLONASS below 1610 MHz. Constellation, for example, noted that the provisions to protect GPS from MSS out-of-band emissions were agreed to in the Committee, but that agreement was "without prejudice to the application of the interference protection model to any other case, i.e., GLONASS, where it would be impractical to provide this same level of protection and for which other solutions are required to avoid harmful interference."[175] LQP notes that while the FAA, ARINC and ATA seek protection of individual GLONASS signals, they have not provided an analysis of why such protection is required to ensure the integrity of the GLONASS system.[176] Motorola contends that the analyses conducted by the aviation community are "skewed" because they have assumed that the MSS transmitter and the aircraft receiver are static when, in fact, both devices are usually mobile.[177] Motorola also lists a number of factors which it argues would provide a more accurate determination of necessary out-of-band emission limits.[178] TRW requests that we incorporate in the rules the ongoing measurement programs and the system vulnerability analyses now being used to determine actual protection requirements of GNSS.[179]

137. We will not adopt out-of-band emission limits to protect GLONASS operations below 1610 MHz at this time. The Committee did not agree on limits and the record indicates that a suitable methodology for determining such limits has still not been agreed upon. We note, however, that RTCA Working Group SC159 ad hoc has been established to assess interference

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[174] FAA Comments at 3-4.

[175] See Constellation Comments at 49.

[176] See LQP Reply at 60-61. On LQP's behalf, Sat-Tech Systems conducted an independent study of GNSS satellite availability. Sat-Tech Systems concluded that since multiple measurements from a number of GPS and GLONASS satellites would always be available, the loss of a single GNSS signal would not impair the ability to navigate using GNSS. LQP Comments, Technical Appendix at para. 2.2.1.

[177] Motorola Reply at 51.

[178] These include the effects of duty cycle, modulation technique, spectral overlap, channel assignment, airframe shielding, time duration of event, and signal processing. Motorola describes in detail the individual impact of each of these factors on the analyses in its reply technical appendix at 1-10.

[179] See TRW Reply at 77 (n. 118).

to GNSS and possible interference mitigation techniques. The aviation community and the Big LEO applicants participate in this group. We expect that the report from SC159 ad hoc will include an assessment of the out-of-band emission limits on MSS operations necessary to protect GLONASS operations below 1610 MHz. We also believe that this information will provide a mutually acceptable out-of-band emission level.

c. Out-of-band interference to ARNS/RNSS from secondary MSS downlinks in the 1613.8-1626.5 MHz band.

138. The Committee also examined the potential for harmful interference to GPS and GLONASS from secondary MSS downlinks in the 1613.8-1626.5 MHz band. It concluded that interference to GPS operations near 1575 MHz from these downlinks would be negligible due to the low power density level of MSS satellite signals at the Earth's surface and the large frequency separation between the MSS and the GPS frequency bands.[180] To protect GLONASS from interference, however, the Committee recommended that space stations that use the 1613.8-1626.5 MHz-band for downlinks not exceed a pfd of -141.5 dbW/m$^2$/4kHz.[181] We proposed this limit in the Notice in rule Section 25.213(c)(3).

139. Motorola requests that we limit proposed Section 25.213(c)(3) to apply only to those frequencies that are used by systems operating in accordance with International Radio Regulation RR 732. Motorola contends that this would "follow any changes in the frequency plan of systems, like GLONASS, operating in accordance with RR 732, and would also avoid restricting the operations of MSS systems in frequencies where there are no aeronautical radionavigation systems and hence no need for a more restrictive power flux density limit."[182] Motorola also asks us to clarify that the pfd limit refers to the pfd level at the Earth's surface.

140. We believe that the pfd limits proposed in Section 25.213(c)(3) can be readily achieved by MSS operators using the 1613.8-1626.5 MHz band for secondary downlink transmissions. We also believe that our intra-service sharing plan provides sufficient separation between the MSS downlink band and GLONASS operations below 1610 MHz so as not to create interference. Nevertheless, we have decided not to adopt the proposed rule containing out-of-band emission limits for secondary MSS downlinks. Adopting such a rule could be construed to imply that the secondary service has some protection rights relative to primary services in the band, which, by definition, it does not.[183]

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[180] Committee Report, note 23, supra, at para. 3.3.8

[181] Committee Report, note 23, supra, at para. 5.2.2.6.

[182] See Motorola Comments at 56.

[183] See note 21, supra.

141. We remind MSS operators that plan to use the 1613.8-1626.5 MHz secondary allocation for MSS space-to-Earth operations that downlink MSS operations shall not cause harmful interference to GLONASS operations in the 1598-1610 MHz band.[184] Further, MSS operators may not claim interference protection from out-of-band GLONASS operations. We also remind MSS operators of the obligation to coordinate secondary downlink operations in the 1613.8-1626.5 MHz band pursuant to RR 731F.[185]

3. Industrial, Scientific, and Medical Emissions at 2400-2500 MHz

142. The 2400-2500 MHz band may be used on a co-primary basis for Industrial, Scientific and Medical (ISM) equipment applications. ISM applications include microwave ovens, door openers, high frequency lighting systems, industrial equipment, and other low power devices. The Committee was unable to reach a consensus as to whether ISM use represents a significant interference problem to MSS downlinks at 2483.5-2500 MHz.[186] In the Notice, we stated that the record in this area was insufficient to propose specific MSS/ISM sharing rules and requested additional comment on this subject.[187]

143. In their comments, LQP and TRW indicate they conducted independent analyses of the potential for ISM operations to cause harmful interference to 2.4 GHz MSS downlinks. LQP concluded that MSS user transceivers operated in an urban environment with full signal quality in 98% of the instances it recorded. Further, it concluded that MSS signals would be usable 99.5% of the time. LQP also noted that because urban areas are usually served by terrestrial cellular networks, a dual mode transceiver could be switched to terrestrial cellular frequencies when very high ISM interference is present.[188] TRW states that its study generally corroborates LQP's conclusion that 2.4 GHz MSS operations should not be adversely affected by ISM transmissions.[189]

144. Consequently, we do not believe any further inquiry into the MSS/ISM sharing situation is warranted. Should sharing be more difficult than anticipated, affected parties may request that we revisit this matter.

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[184] See note 21, supra.

[185] See Section 2.106 of the Commission's Rules.

[186] Committee Report, note 23, supra, at 3.4.9.

[187] Notice, note 2, supra, at para. 67.

[188] LQP Comments, Technical Appendix at 32.

[189] TRW Reply Comments at 86. In earlier comments, TRW suggested that the Commission reassess the permissible levels of unwanted ISM emissions in order to maximize sharing possibilities.

4. Sharing with Fixed Services in the 2483.5-2500 MHz band

145. Over 700 fixed terrestrial stations, including temporary fixed (transportable) stations, are licensed and operating in the United States in the 2483.5-2500 MHz band. These stations are primarily used as links in microwave relay systems serving petroleum companies and as broadcast auxiliary links. Since 1985, however, the Commission has prohibited any further terrestrial licensing in this band.[190]

146. The Committee recognized that MSS spacecraft operating at power flux density (pfd) levels in excess of the levels prescribed by international radio regulation RR 2566 would be required to be coordinated with these "grandfathered" fixed terrestrial stations.[191] It stated, however, that these cases should be infrequent and that, in any event, any interference problems should be resolvable through coordination. The Committee also noted that terrestrial operations could interfere with MSS operations, although no analyses were provided to quantify the sharing constraints needed to prevent such interference. The Committee stated that because there is no inherent reason why fixed services need to continue operating in this frequency band, the Commission should consider moving these fixed stations to a higher frequency band.

147. In the Notice, we accepted the Committee's finding that interference problems between terrestrial fixed-services at 2483.5-2500 MHz and MSS downlinks operating in excess of the prescribed pfd levels may be settled through the coordination process.[192] We requested comment on this assessment. We also specifically requested comment from terrestrial operators, who did not participate in the Negotiated Rulemaking.

148. In the RDSS Allocation Order, we recognized that fixed and temporary-fixed operations are unlikely to pose a serious interference threat to RDSS.[193] We therefore grandfathered all existing station licenses as of July 25, 1985, permitting them to continue operations and subject only to license renewal. However, we acknowledged that coordination would be somewhat more difficult when temporary-fixed stations are involved since RDSS licensees would not have exact information regarding the location of these stations. Therefore, we required temporary-fixed licensees in this band to notify RDSS licensees directly whenever

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[190] Report and Order, Gen. Docket 84-689, FCC 85-388 (released Sept. 13, 1985) (RDSS Allocation Order).

[191] RR 2566 specifies pfd values at the Earth's surface that may be produced by space station emissions. The values vary from -152 to -142 dB ($W/m^2/4$ kHz) depending upon the angle of arrival. International radio regulation RR 753F incorporates these limits. According to RR 753F, if the limits of RR 2566 are exceeded by the MSS, coordination with terrestrial services is required.

[192] Notice, note 2, supra, at para. 62.

[193] See RDSS Allocation Order, note 190, supra, at paras. 18-20.

the station is moved to a new location.[194] A similar interference environment is present with MSS operations. Consequently, we proposed to modify Section 94.61(b)(4) to extend the notification requirement for grandfathered temporary-fixed licensees to MSS licensees as well.[195]

149. The Big LEO parties argue that the Commission should adopt pfd limits for MSS transmissions that are less stringent than those of RR 2566 and that these limits should be implemented as "triggers" for coordination, not as "absolute limits."[196] This would work in the following manner: the relaxed pfd limit would be established as a "trigger level." If the trigger level is not exceeded, no further action would be required. If the trigger level is exceeded, the interference level to terrestrial systems would then be examined, taking into account the individual system characteristics of the MSS system. Only if the protection levels of the second step are exceeded would coordination be required.[197] According to the Big LEO parties, relaxing the pfd levels and applying the coordination trigger method would enable the MSS systems to enhance capacity and sharing with other MSS operators and avoid time-consuming and costly coordination.[198]

150. We adopt the pfd threshold of RR 2566 for our domestic Big LEO systems. The ITU Radiocommunication Study Group, Task Group 2/2 (TG 2/2), is studying the issue of relaxing the pfd limits of RR 2566, with the view to present a recommendation at an upcoming World Radiocommunication Conference (WRC). The Commission participates actively in the work of TG 2/2. We do not believe it would be appropriate to adopt an increase in the allowable pfd limits for MSS downlinks in the 2483.5-2500 MHz band in the United States before limits are agreed upon internationally. Indeed, even if we adopted a relaxation of the RR 2566 pfd limits in the United States, it is questionable whether MSS systems that are not designed for power controlled downlink transmissions would be able to take advantage of this relaxed limit worldwide.

151. We also adopt the notification requirement for grandfathered temporary-fixed licensees to MSS licensees as proposed in the Notice and will not require these stations to relocate. No comments were filed with respect to a possible relocation of grandfathered

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[194] See 47 C.F.R. § 94.61(b)(4).

[195] Notice, note 2, supra, at para. 62 (n. 104). See also Allocation Order, note 1, supra (modifying NG 147 to the Table of Frequency Allocations, 47 C.F.R. § 2.106, to recognize that "grandfathered" terrestrial stations may continue to operate on a primary basis with the MSS.)

[196] LQP Comments at 75, Ellipsat Reply Comments at 24, TRW Reply Comments at 78.

[197] LQP Comments at 77, TRW Comments at 131.

[198] We note also that LQP has, in a separate proceeding, recommended that these limits be raised. LQP Comments at 74; see Petition for Clarification and Partial Reconsideration of Loral Qualcomm Satellite Service, Inc., ET Docket No. 92-28 at 7-10 (filed Mar. 30, 1994).

terrestrial stations. We therefore have no record in this proceeding on which to base a finding that a move would serve the public interest.

5. Fixed Services above 2500 MHz (ITFS/MMDS)

152. The instructional television fixed service (ITFS) and the multi-channel multipoint distribution service (MMDS) operate in the adjacent 2500-2690 MHz frequency band. The Committee found a potential for out-of-band emission interference into MSS downlinks at 2483.5-2500 MHz from operations in the lowest frequency portion of the ITFS/MMDS allocation. It indicated that because both ITFS and MMDS transmissions are similar to those of television broadcast signals, they will cause harmful interference into MSS mobile user transceivers operating up to several kilometers away from an ITFS or a MMDS transmitter. The Committee concluded that stricter limits on ITFS and MMDS out-of-band emissions should be imposed, and recommended that the Commission initiate such a rulemaking.[199] It acknowledged, however, that making these improvements would cost up to $30,000 per ITFS or MMDS station, and that this cost might increase if these stations are converted from analog to digital technology.

153. We stated in the Notice that the record was insufficient to allow us to make a specific proposal in this area.[200] No ITFS representative participated on the Committee nor did the Committee explore the economic and technical tradeoffs that must be considered in developing a solution. Therefore, we requested comment on all aspects of the ITFS/MSS sharing issue, noting that the regulations we ultimately adopt would be based on these comments. We noted that these regulations might require ITFS operators to improve out-of-band suppression, might require MSS operators to accept additional interference, or might require a combination of both.

154. Ellipsat and TRW contend that new out-of-band emission constraints on all ITFS/MMDS stations should be applied immediately to allow for a transition period for these transmitters to conform to new requirements and that, according to Section 74.936 of the Commission's Rules, the "onus is on the ITFS operator to provide the required interference

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[199] Specifically, the Committee concluded that out-of-band emissions from the lowest frequency ITFS/MMDS channel using an analog video signal at 2500-2506 MHz should be limited to -90 dB relative to the carrier at a frequency offset from band edge between 1.25 and 2 MHz, assuming that the channel is operating at 30 dBW e.i.r.p. Adjustments could be made for higher frequency channels and for higher or lower operating e.i.r.p. Currently, ITFS out-of-band emissions extending more than 1 MHz below the lower band edge must be attenuated 60 dB below the peak visual carrier power. See 47 C.F.R. § 74.936(b).

[200] Notice, note 2, supra, at para. 64.

protection to adjacent band services."[201] Further, TRW asserts the licensing of Big LEO systems or the initiation of service should not be delayed to permit ITFS operators additional time to modify their transmitters.

155. The Wireless Cable Association International (WCAI), the National Telephone Cooperative Association (NTCA) and the Corporation for Public Broadcasting (CPB), urge that the Commission adopt rules that will provide adequate compensation to ITFS/MMDS operators for costs associated with improving their transmitters to comply with any stricter out-of-band emission requirements.[202] WCAI also notes that broadband repeaters used by some ITFS and wireless cable system operators to relay signals into areas that would otherwise be unreachable could pose a threat to MSS downlink operations at the upper portion of the 2483.5-2500 MHz band.[203]

156. LQP, in contrast, does not believe that interference is a significant problem. It conducted a study to assess the impact of ITFS/MMDS out-of-band interference to MSS downlinks in the 2483.5-2500 MHz band and concluded that no harmful interference to MSS operations will result from ITFS/MMDS, including operations of ITFS/MMDS booster stations, and that stricter standards on ITFS/MMDS out-of-band emissions are not necessary. LQP maintains that: 1) MSS downlink operations below 2488.75 MHz will not experience interference from ITFS stations, 2) in urban areas, where ITFS transmitters are prevalent, MSS dual mode transceivers can be used to switch customers to existing terrestrial cellular radio facilities, and 3) MSS user transceivers operating in the highest channel frequency in the 2483.5-2500 MHz band within an ITFS coverage area will be able to operate satisfactorily in all but a few extreme situations by rejecting the ITFS visual carrier and other out-of-band emissions.[204]

157. TRW urges that the LQP study "may have taken an overly optimistic view of the interference situation."[205] TRW also contends that MSS systems using wider CDMA channels (e.g., 5 MHz or wider) may not have the flexibility to move to a lower frequency channel and

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[201] TRW Comments at 132, Ellipsat Reply Comments at 24. Section 74.936 of the Commission's rules, which pertains to ITFS facilities, states that "should interference occur as a result of emissions outside the assigned channel, additional attenuation may be required." 47 C.F.R. § 74.936.

[202] WCAI Comments at 3 and 6, NTCA Comments at 2-3, and CPB Comments at 6.

[203] WCAI Comments at 4.

[204] LQP Comments, Technical Appendix, at 27.

[205] TRW Reply Comments at 79.

that until further required measurements are taken and MSS system designs are finalized, the impact of ITFS/MMDS out-of-band interference is not certain.[206]

158. Upon review of the technical information in the record, we see no significant threat of harmful out-of-band emission interference into MSS from ITFS/MMDS operations above 2500 MHz. Well designed CDMA receivers should mitigate the effect of out-of-band emissions from ITFS/MMDS. Additionally, a MSS user transceiver's dynamic channel switching capability should reduce any adverse affects from ITFS/MMDS. Further, our intra-service sharing plan allows enough 2.4 GHz band spectrum for MSS operators to avoid ITFS/MMDS out-of-band emissions in the upper portion of the allocation. Consequently, we will not initiate a proceeding to restrict further the out-of-band emissions on ITFS/MMDS at this time.

6. Other Terrestrial Services provided outside of the United States

159. In sixteen countries throughout the world, the 1550-1645.5 MHz band is allocated on a primary basis to the fixed service pursuant to international Radio Regulation RR 730.[207] Ground-based aeronautical radionavigation services (ARNS) are also operating throughout the world in the 1610-1626.5 MHz band pursuant to RR 732.

160. The Committee concluded that existing fixed stations operating in the 1610-1626.5 MHz band pursuant to RR 730 and ground-based ARNS stations operating pursuant to RR 732 will not cause harmful interference to MSS operations. It also concluded that MSS operations will not cause harmful interference to these terrestrial services. Consequently, we proposed only to reiterate in Section 25.213(d) of our rules the general obligation that MSS stations shall not cause interference into stations operating under RR 730. The requirement that MSS stations shall not cause interference to, or claim protection from, stations operating pursuant to RR 732, (international Radio Regulation RR 732 encompasses both ground-based and satellite-borne ARNS), was addressed by proposed rule section 25.213(c)(1), which was adopted earlier in this order.[208]

161. Constellation contends that we should not adopt proposed Section 25.213(d) since there are no U.S. systems operating pursuant to RR 730.[209] We disagree. We have repeatedly emphasized in this proceeding that the operation of LEO MSS systems is inherently global. Though there are no systems operating in the United States pursuant to RR 730, it is important

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[206] TRW Technical Appendix to Reply Comments at A-24.

[207] These countries are Austria, Bulgaria, Cameroon, Germany, Guinea, Hungary, Indonesia, Libya, Mali, Mongolia, Nigeria, Poland, Romania, Senegal, Czechoslovakia, and the former U.S.S.R.

[208] See para. 128, supra.

[209] Constellation Reply Comments at 47 and Constellation Comments at 53.

that we make clear the obligations of Big LEO operators to coordinate their systems worldwide. Our rules do not elsewhere address coordination of Big LEO systems with systems operating pursuant to RR 730.

162. We therefore adopt Section 25.213(d), as proposed, with the caveat that the coordination and notification procedures fall under Resolution 46 (WARC-92).[210] International Radio Regulations RR 731E and RR 731F require, respectively, that MSS uplink transmissions in the 1610-1626.5 MHz band and MSS downlink operations in the 1613.8-1626.5 MHz band be coordinated and notified pursuant to Resolution 46 (WARC-92). Also according to RR 731E, MSS mobile earth terminals may not cause interference to terrestrial stations operating in accordance with RR 730 and they may not claim interference protection from these terrestrial stations. We note that all transmitting MSS subscriber terminals will be subject to the regulatory requirements of those countries in which they are operating. User countries will be responsible for undertaking all necessary coordination with neighboring countries to protect fixed or terrestrial aeronautical radionavigation operations from MSS mobile earth terminals in those neighboring countries. Any secondary MSS downlink operations in the 1613.8-1626.5 MHz band also may not cause harmful interference into terrestrial services operating pursuant to RR 730 or 732. Nor may a MSS mobile earth terminal which receives secondary downlink transmissions claim protection against harmful interference from these terrestrial operations unless a particular country has agreed to provide this protection.

## C. Feeder Links

163. In addition to the mobile links connecting customers with the MSS system, one or more "gateway" or central earth stations are needed to complete the transmission paths, process the information being transmitted, and interconnect the system with other communications networks or with other user transceivers. Without these "feeder links," an MSS system would be useless. Because feeder links operate with gateway stations at fixed locations, the feeder link operates in frequency bands allocated to the fixed-satellite service (FSS).

164. The six applicants requested a variety of feeder link frequency bands and bandwidths. In their applications, Constellation, Ellipsat, and LQP each requested 66 MHz of spectrum in each transmission direction in the 5/6 GHz C-band. Motorola and TRW each requested approximately 100 MHz in each direction in the 20/30 GHz Ka-band. AMSC requested an unspecified amount of spectrum in the 12/14 GHz Ku-band.[211] We note, however, that four of the applicants, in the Joint Proposal, indicate that their feeder link spectrum requirements have increased significantly since they filed their original applications. As recognized in the Notice, the FAA has opposed use of the 5 GHz portion of the C-band for space-to-Earth feeder links because of the interference potential between the feeder links and a

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[210] See Motorola Comments at 56.

[211] Committee Report, Annex 3, Report of Working Group 3, at 2.

navigation system it is considering developing in this band.[212] The 27.5-29.5 GHz portion of the Ka-band was the subject of a recently completed Negotiated Rulemaking involving various terrestrial and satellite interests seeking to use the band. The Negotiated Rulemaking Committee was unable to devise sharing criteria that would satisfy the feeder link requirements of more than one Big LEO applicant.

165. In the Joint Proposal, the parties nevertheless request the Commission to proceed with licensing. They state that licenses can be issued to those applicants requesting to operate in feeder link bands that are available for assignment at the time of licensing. They suggest that conditional licenses be awarded to applicants requesting to operate in feeder link bands that are not available. According to the parties, the license would contain a range of feeder link frequencies that the licensee will be able to use provided that those frequencies become available for Big LEO feeder links and are assigned to that licensee by the Commission.

166. We agree that we should award Big LEO licenses as quickly as possible. While we are optimistic that sufficient spectrum will be identified to support Big LEO feeder link operations, we are not certain when this will occur. It is very likely that we will not be in a position to assign specific feeder link spectrum to any qualified applicant by our target date for licensing in January 1995. Even if we were able to assign specific feeder link spectrum to some, however, we would not issue unconditional grants to some and conditional grants to others as the applicants suggest. Until we are certain that the feeder link requirements of all qualified applicants will be met, we will not foreclose our options by assigning spectrum unconditionally.[213] We will permit applicant to notify us whether they would prefer to have conditional feeder link frequencies included in their authorizations or whether they would prefer their initial license to be silent on this issue. We envision granting unconditional licenses, including specific feeder link frequencies, at the earlier of two events: (1) domestic allocations sufficient to support all Big LEO systems are available, regardless of frequency band or (2) the completion of the upcoming World Radio Conference in the Fall of 1995 (WRC-95) assuming sufficient spectrum is made available to satisfy these feeder link requirements. If sufficient feeder link spectrum to support all licensed Big LEO systems is not identified by the completion of the WRC, we will need to develop a further processing mechanism to assign feeder link bands to Big LEO licensees. In the interim, we will continue our international efforts to identify feeder link spectrum at or below 15 GHz.

167. To this end, in preparation for the WRC, ITU-Radiocommunications Study Group Task Groups 8/3 and 4/5 are attempting to define spectrum requirements, to identify available frequencies and to evaluate sharing possibilities with existing and future users of the band. When

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[212] See Notice, note 2, supra, at para. 75.

[213] We will, however, take action on requests for waiver of the construction permit requirement under Section 319(d) of the Communications Act, 47 U.S.C. § 319(d). If an applicant's waiver request were approved, it would permit the applicant to commence construction of its system, including the feeder links, at the applicant's own risk.

these Groups complete their work in December of this year, both will prepare Reports to the Conference Preparatory Meeting (CPM)-95. These Reports will form the basis for the CPM's Report to WRC-95 on feeder links, which will be the technical basis for international decisions regarding feeder links and the International Table of Allocations.

168. Since the frequencies to be used for LEO feeder links may also be used by GSO satellites, Task Group 4/5 is studying the sharing potential between LEO and GSO satellites in all FSS allocations between 3 and 31 GHz. These studies have indicated that certain FSS frequency bands are used more extensively by GSO FSS systems and other radio services and that these bands are therefore less likely candidates for LEO MSS feeder links due to sharing difficulties. In bands at or below 15 GHz, the 5000-5250 GHz and 15.4-15.7 GHz frequencies appear to be promising candidates for reallocation for LEO feeder links.[214] Task Group 4/5 has also studied the interference created by antenna beam coupling between GSO earth stations and LEO satellite stations,[215] and is exploring ways to reduce interference through a variety of coordination procedures, including geographic exclusion zones, reverse band operation, and dedicated frequency allocations for LEO satellite feeder link use. When these studies are completed, we will have an indication as to which bands may be recommended and, hopefully, made available internationally for MSS feeder links at WRC-95.

169. Nevertheless, as we stated in the Notice, we will not allow the uncertain availability of bands below 15 GHz to delay the licensing and implementation of Big LEO systems. Consequently, if sufficient spectrum is made available at 20/30 GHz to accommodate all Big LEO licensees before bands below 15 GHz are identified, we will authorize all licensees in the 20/30 GHz band, recognizing that several applicants will be faced with substantial system design and service concept modifications. We will continue, however, to pursue bands at and below 15 GHz for Big LEO feeder links, and will allow licensees to modify their licenses to request operational authority in any new bands if, and when, they become available.

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[214] Task Group 4/5 forwarded a preliminary study to TG 8/3 that identified the 5000-5250 GHz and 15.4-15.7 GHz bands as strong candidates for Non-GSO Earth-to-space feeder links. The study indicated that TG 4/5 was of the preliminary view that sharing of non-GSO feeder links (both downlinks and uplinks) with Aeronautical Radionavigation Services (ARNS) in these bands appeared feasible, since the interference to microwave landing system (MLS) receivers would be within the assumed permissible levels. ICAO, at Task Group 8/3, objected to this study, but further analysis is underway and the bands are still being considered as possibilities within these international forums.

[215] Antenna beam coupling occurs when a LEO satellite passes below a GSO satellite and crosses into the transmission path of an earth station to the GSO satellite. At that point, the transmission beams from the LEO satellite and the earth station will intersect. If the LEO and GSO systems are operating in the same frequency band, this "coupling" will produce significant interference for very short durations of time when the earth station, LEO and GSO satellites form a straight line.

## D. Intersatellite Links

170. Motorola's proposed system includes intersatellite transmission links in the 23.18-23.38 GHz band. This proposal falls within the intersatellite service allocation at 22.55-23.55 GHz. The Committee concluded that Motorola's use of this band would be compatible with other operations in the band, which include operations by NASA, the radio astronomy service, and fixed-terrestrial services. The Committee noted, however, that NASA has indicated it would prefer that any future MSS intersatellite links operate in the 24.45-24.75 GHz band, which recently was allocated internationally and domestically for intersatellite links. Nevertheless, the Committee, which included a representative of NASA, proposed that we adopt a rule indicating that the 22.55-23.00 GHz, 23.00-23.55 GHz, 24.45-24.65 GHz, and 24.65-24.75 GHz frequencies are available for use by the intersatellite service. In the Notice, we proposed to adopt the Committee's recommended rule regarding intersatellite service frequencies, coordination with government agencies, and sharing criteria. We adopt the rule as proposed with several minor changes and clarifications suggested by Motorola.

## E. Service Rules

### 1. Regulatory Treatment

171. In the Notice, we asked parties to comment on our tentative conclusion that Big LEO MSS service may be offered as a commercial mobile radio service (CMRS). We further sought comment on whether we should exercise our discretion under Section 332(c)(5)[216] to determine that Big LEO space station licensees making satellite capacity available to CMRS providers shall be required to operate as common carriers. In the alternative, we asked parties to comment on how we should regulate Big LEO space station operators if they are not offering CMRS. We noted that when making determinations regarding common carriage obligations in the past, the Commission has examined individual service proposals in light of the criteria delineated in National Association of Regulatory Utility Commissioners v. FCC, 525 F.2d 630, 642 (D.C.Cir.), cert. denied, 425 U.S. 999 (1976) (NARUC I).[217] Referencing the two-pronged test in NARUC I, in the Notice, we requested comment regarding (1) the likelihood that space station capacity in this service will be offered indifferently to the public, and (2) if there is no such likelihood, whether there should be a legal compulsion for space segment providers to serve the public indifferently.[218] We also asked for comment on the impact of requiring common

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[216] Section 332(c)(5) reads as follows: "SPACE SEGMENT CAPACITY. Nothing in this section shall prohibit the Commission from continuing to determine whether the provision of space segment capacity by satellite systems to providers of commercial mobile services shall be treated as common carriage." 47 U.S.C. § 332(c)(5).

[217] Notice, note 2, supra, at para. 80.

[218] Id. at paras. 80-81.

carrier operation on the amount of foreign investment and the international coordination of these satellites, given the requirements of Section 310(b) of the Act.[219]

172. In a recent rulemaking, we determined the classification and regulatory treatment of providers of CMRS.[220] Regarding satellite services, we held that, to the extent that a space station licensee provides a service that meets the elements of the CMRS definition,[221] we will generally regulate the provision of that service on a common carrier basis.[222] We concluded, however, that so long as the service provider is not providing service directly to end users, the Commission retains the authority under Section 332(c)(5) to continue to employ its existing procedures to determine whether the provision of space segment capacity by satellite licensees to CMRS providers will be offered on a common carrier or private carrier basis.[223] We also determined that the Commission has the discretion to extend this treatment to any entity that sells or leases space segment capacity, to the extent that the entity is not providing CMRS directly to end users.[224]

173. Motorola and LQP agree that the Commission must regulate Big LEO space station licensees as common carriers to the extent that they provide CMRS to end users.[225] If the licensees offer only space segment capacity to resellers, however, the parties contend that this provision of service does not fall within the definition of CMRS, and therefore need not be made

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[219] Id. at para. 81.

[220] Implementation of Sections 3(n) and 332 of the Communications Act, 9 FCC Rcd 1411 (1994) (CMRS Second Report and Order), recon. pending.

[221] Id. at 1457-58. A commercial mobile radio service is defined as "any mobile service (as defined in section 3(n)) that is provided for profit and makes interconnected service available (A) to the public or (B) to such classes of eligible users as to be effectively available to a substantial portion of the public, as specified by regulation by the Commission." 47 U.S.C. § 332(d)(1). A private mobile radio service is defined as "any mobile service (as defined in section 3(n)) that is not a commercial mobile service or the functional equivalent of a commercial mobile service, as specified by regulation by the Commission." 47 U.S.C. § 332(d)(3).

[222] It should be noted, however, that we have chosen to forbear (pursuant to Section 332(c)(1)(A)) from the application of certain provisions of Title II of the Act with regard to CMRS providers. As such, for example, CMRS providers are not permitted to file tariffs for their services. See CMRS Second Report and Order, note 220, supra, at 1478-80.

[223] Id. at 1457-58.

[224] Id. at 1457.

[225] Motorola Comments at 67-68.

available on a common carriage basis.[226] LQP argues that in this situation, the public is assured common carriage access to the service because, at some point a reseller will meet the definition of a CMRS provider and will be required to operate as a common carrier.[227]

174. Big LEO space station licensees providing service directly to end users must be regulated as common carriers if the service offering meets the definition of CMRS. We will determine whether a service offering meets that definition based on the service description contained in the operator's application. Operators with pending applications may amend their applications to the extent necessary to enable us to make the determination regarding the nature of the service.[228]

175. Pursuant to Section 332(c)(5), however, if space segment capacity is offered by a Big LEO space station licensee to a reseller or other entity who then offers CMRS to end users, we have the discretion to determine whether to require the Big LEO licensee to offer such service on a common carriage basis, or to permit such offering to be made on a private carriage basis. In making this determination, we have looked to the analysis enunciated in NARUC I.

176. Regarding the first prong of the NARUC I test, the commenters agree unanimously agree that nothing in the nature of the applicants' service proposals supports a conclusion that their services will be offered indifferently to the public. Motorola points out that it and the other applicants propose to market their space segment capacity to a small number of resellers, and to tailor these offerings to the individual requirements of these few customers. Motorola contends that such offerings have never been viewed as "common carriage" under the NARUC I standard.[229] Constellation, LQP, TRW, and AirTouch concur, noting that Commission has historically viewed a service provider's lack of intent to serve end users as an indication of non-common carriage.[230]

177. We agree with the commenters that the record in this proceeding does not support a finding that the proposed space segment services are likely to be offered to the public

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[226] See, e.g., TRW Comments at 153-54 & n.239; LQP Comments at 97-98.

[227] LQP Comments at 97, 100.

[228] See para. 2, supra.

[229] Motorola Comments at 64-65 (asserting that space capacity on the IRIDIUM system will never be offered directly to the public; rather, it will be provided on a wholesale basis to the operators of the IRIDIUM system gateways, who in turn may provide services to end users or sell capacity in bulk to service providers, or both).

[230] Constellation Comments at 60; LQP Comments at 97-98; TRW Comments at 158-160; Airtouch Comments at 9-10.

indifferently, a basic characteristic of common carrier service.[231] First, in cases where licensees have not intended to serve the user public directly, the Commission has found services to be non-common carrier in nature. In Domestic Fixed-Satellite Transponder Sales, for example, the Commission noted the slim likelihood that non-common carrier domestic satellites would hold themselves out indifferently to serve the user public as key to its decision to permitted qualified persons to apply for domestic satellite licenses for non-common carrier purposes.[232] More recently, the Commission, in assessing its discretion under Section 332(c)(5), held that non-voice, non-geostationary (NVNG) MSS space station licensees would be permitted to provide system access to CMRS providers on a non-common carrier basis.[233] Second, these limited offerings will be tailored to provide resellers with a wide variety of options, ranging from position determination and data messaging services, such as those proposed by the NVNG MSS proponents, to global telephony. Consequently, there is nothing in this record to support a finding that the services will be offered indifferently to the public.

178. Regarding the second prong of the NARUC I test, the commenters unanimously agree that there should be no legal compulsion for space segment providers to serve the public indifferently. AirTouch and other commenters allege that there will be significant competition in the provision of these services to CMRS providers, both from Big LEO systems, as well as from GSO MSS and NVNG MSS systems.[234] These commenters also assert that sufficient capacity will be available to assure service availability to those that wish to receive it.[235] TRW further contends that the danger of unreasonable or anticompetitive practices that common carrier regulation is designed to prevent will not exist in the competitive environment in which Big LEO licensees will operate because five applicants seek authority to operate these services.[236]

179. We concur that there does not appear to be a need to impose common carrier requirements on Big LEO licensees at this time. The Commission has found the presence of capacity and the resulting competition to be an important factor in determining whether non-

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[231] See para. 171, supra. See also Motorola Comments at 64.

[232] Domestic Fixed-Satellite Transponder Sales, 90 FCC 2d 1238, 1256-57 (1982), aff'd, Wold Communications, Inc. v. FCC, 735 F.2d 1465 (D.C.Cir. 1984), modified Martin Marietta Communications Systems, Memorandum Opinion and Order, 60 Rad.Reg. (P&F) 2d 779 (1986).

[233] NVNG MSS Order, note 48, supra, at 8456.

[234] See, e.g., Airtouch Comments at 7-8; Ellipsat Comments at 46; TRW Comments at 156-157.

[235] Airtouch Comments at 8; TRW Comments at 157; Ellipsat Comments at 46.

[236] See TRW Comments at 156. See also Motorola Comments at 63.

common carrier treatment should be permitted.[237] As the commenters state, competitive voice mobile services already exist or are imminent. Furthermore, satellite-delivered radiolocation and messaging services are currently provided by a Commission licensee,[238] and are proposed by a number of NVNG MSS applicants.[239] Moreover, under our rules adopted today, sufficient spectrum is available to support the grant of up to five of the pending Big LEO applications.[240] Thus, significant direct competition is approaching.[241] We accordingly believe that sufficient competitive capacity will be available to assure the public of ample access to these services. Therefore, we find that there is no reason to require the provision of space segment capacity to be offered to resellers on a common carrier basis.[242] Of course, if a space segment capacity provider chooses to provide service on a common carrier basis, that service provider would be

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[237] Domestic Fixed-Satellite Transponder Sales, note 232, supra, at 1250-53.

[238] See Qualcomm, Inc., Application for Blanket Authority to Construct and Operate a Network of 12/14 GHz Transmit/Receive Mobile and Transportable Earth Stations and a Hub Earth Station, 4 FCC Rcd 1543 (1989).

[239] Final rules have been adopted establishing the NVNG mobile-satellite service, and three applications are pending. See NVNG MSS Order, note 48, supra.

[240] See paras. 44-45, supra.

[241] There is also support in antitrust law and policy for examining potential competition for that purpose. See Implementation of Sections 3(n) and 332 of the Communications Act, Regulatory Treatment of Mobile Services, Amendment of Part 90 of the Commission's Rules To Facilitate Future Development of SMR Systems in the 800 MHz Frequency Band, Amendment of Parts 2 and 90 of the Commission's Rules to Provide for the Use of 200 Channels Outside the Designated Filing Areas in the 896-901 MHz and 935-940 MHz Band Allotted to the Specialized Mobile Radio Pool, GN Docket No. 93-252, PR Docket No. 93-144, PR Docket No. 89-553, FCC 94-212, at paras. 69-70, (released Sept. 23, 1994).

[242] We emphasize that our decision with regard to the regulatory status of the provision of space segment capacity is taken pursuant to the Commission's authority under Section 332(c)(5). Therefore, our actions here should not be viewed as altering our decision in the CMRS Second Report and Order regarding individualized or customized service offerings made by CMRS providers to individual customers. As we explained in the CMRS Second Report and Order, individualized or customized offerings will be classified and regulated as CMRS, regardless of whether such offerings would be treated as common carriage under existing case law, if the service falls within the definition of CMRS. See CMRS Second Report and Order, note 220, supra, at 1439 and n.130. We also explained that the public availability prong of the CMRS definition is met unless the service is used for a licensee's internal use or if Commission rules limit eligibility to specified user groups. Id. at 1441.

subject to regulation as a CMRS provider.[243] The Commission has forborne from applying certain provisions of Title II to CMRS providers.[244]

180. In so finding, we recognize that the commenters argued the imposition of common carrier requirements may have an adverse effect on the development of this service. AirTouch and others argue that Section 310(b) restrictions on foreign involvement in the affairs of domestic common carrier licensees may significantly hinder investment by foreign entities, as well as their willingness to allow a U.S. licensee to operate within their own borders.[245] The commenters allege that this investment is critical to the development of a global satellite service.[246] Further, Motorola states that the submission of U.S. service providers to common carrier requirements will inhibit their ability to compete with foreign systems that are not similarly encumbered.[247] LQP concurs, noting that the space station licensees should be free to tailor their business plans to their respective customer bases.[248]

181. While we have already found that common carrier requirements need not be imposed on space segment operators providing service to resellers, there are several other factors that militate against the imposition of common carrier requirements, particularly those limiting alien ownership under Section 310(b) of the Communications Act. Specifically, these systems are inherently global, and extremely expensive. Systems may be comprised of as many as 66 satellites, only a small number of which are visible over the United States at any one time. Because of their global nature, many systems are raising capital in international markets.[249] As such, it is reasonable to expect that investors will want to be involved with system operation, particularly if the system will be accessed from the investor's jurisdiction. We concur that this foreign participation is likely to improve the likelihood of receiving a grant of space station access by foreign administrations.

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[243] See CMRS Second Report and Order, note 220, supra, at 1475-90.

[244] See 47 CFR § 20.15.

[245] See Airtouch Comments at 4-7. See also TRW Comments at 161-163.

[246] See Ellipsat Comments at 46; Airtouch Comments at 5-6; Motorola Comments at 66-67.

[247] Motorola Comments at 66-67.

[248] LQP Comments at 99.

[249] See, e.g., Motorola Comments at 67; TRW Comments at 161-162 (noting that global geostationary satellite systems, like Panamsat, also have found it necessary to form partnerships with foreign companies in order to raise foreign capital).

2. System License and License Term

182. As proposed in the Notice, and unanimously endorsed by the parties, we will follow the policy we established in licensing NVNG MSS systems, which are also composed of constellations of technically identical LEO satellites. Specifically, we will issue a single "blanket" authorization for the construction, launch, and operation of all the satellites in an entity's constellation. This authorization will cover all construction and launches necessary to put the complete constellation into place and to maintain it until the end of the license term, including any replacement satellites necessitated by launch or operational failures, or by the retirement of satellites prior to the end of the license period. All replacement satellites, however, must be technically identical to those in service and may not cause a net increase in the number of operating satellites.[250] This blanket authorization will include any in-orbit spares for which the applicant seeks authorization as part of its system. Any such spares can be activated as required. Within ten days of activation, the licensee must certify to the Commission that the activation did not cause it to exceed the total number of operating satellites for which its system is authorized. Any spares or replacements that do not fall under the blanket authorization will need separate authorizations to build, launch and operate, but their terms will expire concurrently with the blanket authorization. As proposed in the Notice, the license will run from the date on which the first space station in the system begins transmissions and will be valid for a ten-year period.

183. Some applicants urge us to permit replacement satellites that are "functionally equivalent" to those authorized or have "the same particulars of operation," to enable them to more readily include evolutions in design into newer satellites. These are the same proposals and arguments we rejected when we adopted the blanket authorization standards for NVNG MSS satellites.[251] In the absence of arguments or evidence demonstrating that the NVNG MSS service is not analogous to the Big LEO service, we continue to believe our interests in assuring the continued compatibility of the subject systems with other users of the spectrum outweigh any convenience for licensees in a laxer standard. A modification application to upgrade satellite design will not be unduly burdensome and should not impede technical innovation.

184. We also deny the request of LQP and Constellation that a licensee be permitted to put "spare" satellites into service under their blanket license in order to enhance their systems. These parties would require only that there be no overall increase in effective isotropically radiated power (e.i.r.p.), pfd, or any other sharing criterion, and argue that this policy would allow licensees to increase path diversity, which can be a significant service improvement for CDMA systems. We are not convinced by LQP and Constellation that other operators would not

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[250] Technically identical satellites must have identical satellite antenna footprints and transmission parameters. They need not, however, have the identical physical structure or microelectronics.

[251] See NVNG MSS Order, note 48, supra, at 8452.

be affected by the operation of facilities that have not been specifically analyzed and appropriately authorized. Accordingly, we affirm our requirement that any satellites that an applicant wishes to include in its system must be specified in its initial application or a modification application.

185. We proposed in the Notice that license terms will begin automatically with the first transmission from the first authorized satellite, and will continue for ten years.[252] All parties agree with the length of the license term. One party proposes that a license term should commence only after commencement of actual service or within six months of launch, whichever occurs first. Apparently, the concern is that the license term will begin to run before a licensee has launched a sufficient number of satellites with which to begin commercial operations. This overlooks our general policy that, because all transmissions are capable of causing interference, satellite license terms in all satellite services begin when radio transmissions commence. We will not treat Big LEO operators differently by permitting them to engage in any transmissions, whether those transmissions are to test the system's functioning or to provide a fully implemented commercial service, without a valid operating license. Further, we do not believe that Big LEO operators will be unduly burdened if the license term for the system begins to run on the date of the first transmission. If fuel is left on the satellite after its license term has expired, we will entertain a request for special temporary authority to continue to operate if that location has not been assigned to a new system.[253] Thus, we adopt our rule as proposed.

186. We also proposed a filing window for system replacement applications identical to the one implemented in the analogous NVNG MSS service. Specifically, we proposed that applications for the next generation Big LEO systems must be filed no earlier than three months prior to and no later than one month after the end of the seventh year of the existing license.[254] Motorola, LQP and Constellation variously contend that some replacement applications could affect other licensees' rights and thus potentially affected licensees should be able to file replacement applications earlier. No party has explained, however, why our proposed rules fail to provide adequate opportunity for affected entities to respond to proposed replacement systems, thus protecting their rights. We will therefore adopt the filing window for replacement systems as proposed.

187. In the Notice, we stated that we intend to grant replacement applications if frequencies remain available for use by such systems, consistent with our practice for other

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[252] This follows the one-step processing and licensing policy that has been used for satellites since 1980. See 1980 Assignment Order, 84 FCC 2d 584 (1981).

[253] In the past, we have granted such requests when continued operations will not prevent a state-of-the-art satellite from taking its place. See, e.g., Hughes Communications Galaxy, Inc., 9 FCC Rcd 217 (1994); Hughes Communications Galaxy, Inc., 9 FCC Rcd 218 (1994); and American Telephone and Telegraph Co., 8 FCC Rcd 8741 (1993).

[254] Proposed Section 25.120(e).

satellite services.[255] Three applicants urge us to adopt an explicit replacement expectancy, with TRW proposing a specific provision that would provide such an expectancy upon a licensee's consistent regulatory compliance. The Commission, however, has historically rejected establishing an explicit replacement expectancy for space station systems.[256] We have repeatedly noted circumstances such as intervening international agreements or changes in technology may affect our determination as to whether a replacement system would serve the public interest. We assure Big LEO licensees that given the enormous investment necessary to construct and operate a satellite system, we will consider replacement applications in this service similar to other satellite services, that is, we will grant authority to implement a next generation system unless extraordinary circumstances prevent us from doing so.

3. Implementation Milestones

188. As proposed in the Notice, we will adopt a set of satellite construction milestones modeled on those used in the NVNG MSS service. All parties agree that implementation milestones to monitor the progress of system implementation are advisable, and most parties approve of the essential elements of our proposed milestones, with certain minor clarifications and modifications, some of which we are adopting.

189. Each licensee will be required to adhere to a strict timetable for the system implementation. Failure to meet this timetable will render the authorization null and void. We will generally require each licensee to begin construction of its first two satellites within one year of the unconditional grant of its authorization, and complete construction of those first two satellites within four years of that grant. Construction for the remaining authorized operating satellites in the constellation must begin within three years of the initial authorization, and the entire authorized system must be operational within six years.[257] While we do not intend to deviate from these requirements for commencing construction, we may authorize a different schedule if an applicant concretely demonstrates that its proposed system's size and/or complexity warrants additional time because of the size or complexity of its proposed system.[258] In every case, the licensee's individual milestone timetable will be set and become a condition of its authorization. Some parties propose that we consider granting extensions of time to a licensee that has launched at least part of its system. We will not adopt such a provision, which would suggest that we will not enforce strictly the system completion requirement. Incomplete systems will not justify the reservation of the orbit/spectrum resource from other potential users, and

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[255] Notice, note 2, supra, at n.134.

[256] See, e.g., Assignment of Orbital Locations to Space Stations in the Domestic Fixed-Satellite Service, 3 FCC Rcd 6972 (1988 Assignment Order), at n. 31.

[257] Some applicants' suggestions for additional milestones are based on their mistaken belief that the Notice did not include a final system completion requirement.

[258] See Notice, note 2, supra at 1136.

applicants should not anticipate that their authorization will require anything less than a complete commitment of those resources necessary to execute the full global system upon which their authorization is premised.

190. We also will not impose a separate deadline for construction of in-orbit spares. We will leave the determination of what is an appropriate timetable for building or launching in-orbit spares to each licensee. It is reasonable to believe that if the rest of the system is implemented in a timely fashion, any in-orbit spares will also be put into place on a timetable deemed prudent by the operator. Moreover, we do not wish to discourage applicants from proposing as many in-orbit spares for inclusion in their initial blanket authorizations as they deem appropriate.

191. Some of the parties ask us to forego the construction commencement milestone in favor of a timetable that would focus only on the initiation of commercial service. They primarily contend that our milestones are unfair to those systems that could begin to provide service in stages (and, presumably, finance construction of the last satellites from initial revenue streams). We are concerned, however, that such a timetable would prevent prompt identification and elimination of those applicants that are not, for whatever reason, committed to building a system expeditiously that is capable of providing global service.[259] Most applicants fully support a global coverage requirement.[260]

192. Several applicants suggest that we adopt a more detailed standard or a series of milestones to enable us to track implementation progress more closely. LQP argues that this could result in long undetected delays in progress. We do not believe interim milestones are necessary. The annual reporting requirements (further discussed below) and our ability to demand additional contract and construction information should enable us to respond promptly to any implementation failures.

193. Motorola suggests that we require a specific and significant portion of the ground segment to be constructed on the same timetable as the space segment.[261] Such a requirement, opposed by all other applicants, is undesirable. As noted, service provision in foreign countries will be subject to a particular country's authorization. We cannot require a licensee to meet an implementation milestone when its ability to do so is outside of its control. In any event,

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[259] Any applicant whose financial capability would be so constrained by the proposed construction milestones likely will not meet our financial qualifications. The milestones and the financial requirements provide a balanced approach to determining the actual capability of the applicants to implement the system and service they propose.

[260] See paras. 21-23, supra.

[261] Motorola would require a ground segment covering 75% of the world's population and 75% of the world's land area within six years of initial system authorization.

licensees that have launched enough satellites to provide service should have no difficulty constructing their corresponding earth segments.

4. Reporting Requirements

194. We will also generally follow the NVNG MSS rules for annual reporting requirements for this service, as proposed in the Notice and supported by most parties. Every licensee must provide an annual report fully describing the status of its construction, system loading and any outages or malfunctions that have occurred during the reporting period. These reports will be required on June 30 of each year.

195. Although several applicants argue that the information requested is either too burdensome or too proprietary in nature for dissemination, we believe this information is needed to allow us to evaluate whether, and to what extent, the spectrum is being used and to monitor construction progress. Licensees may request confidentiality for any portion of their report, pursuant to Section 0.459 of the Commission's rules, 47 C.F.R. § 0.459. As proposed in the Notice, we will also require that each licensee to certify to us within ten days of the date of any milestone requirement that the milestone was met or to advise us that it was not.

5. Distress and Safety Communications

196. Although Big LEO applicants did not indicate that they plan to use their systems for extensive distress and safety communications, we recognized in the Notice that because these systems have position determination capability,[262] they have the potential to complement existing search and rescue (SAR) and disaster response services. Further, although we recognize that Big LEO services cannot be used in lieu of distress beacons, such as satellite emergency position locator transmitters or emergency indicator radio beacons, that are required to be carried by international agreement or statute,[263] Big LEO system operators have certain obligations relating to maritime distress communications under Sections 321(b) and 359 of the Communications Act, 47 U.S.C. §§ 321(b), 359.[264] Other than these mandated requirements, we did not propose to

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[262] See para. 104, supra.

[263] Compulsory equipment carriage requirements are established in portions of the Commission's rules as well as by statute. See, e.g., 47 C.F.R. §§ 80.801, et seq.; Ch. IV, International Convention on the Safety of Life at Sea, 32 U.S.T. 47, T.I.A.S. 9700 (1974).

[264] Specifically, Section 321 of the Communications Act, 47 U.S.C. § 321, requires, inter alia, that all radio stations including Government stations and foreign ship stations within U.S. territorial waters, give absolute priority to radio communications or signals relating to ships in distress. Section 359 of the Communications Act, 47 U.S.C. § 359, requires, inter alia, that U. S. ships that encounter dangers to navigation such as, dangerous ice or winds whose force is 10 or above on the Beaufort scale must transmit such information to ships in the vicinity and authorities on land. Section 359 also prohibits ships or mobile stations from charging for

require Big LEO systems to provide search and rescue or disaster response communications as a general service offering. We stated, however, that we expected that any satellite licensee that chose to offer emergency or safety communications services will coordinate its effort with the appropriate search and rescue organizations.[265] These requirements were contained in proposed rule section 25.143(f).

197. Mr. Bernard Trudell (Trudell) states that in cases of emergency all MSS providers should be required to comply with standards and call routing that will ensure the safety and well being of the public.[266] Additionally, Trudell states that most MSS providers indicated that they would provide distress and safety services in part as justification for license authority.[267] Trudell concludes that the Commission should require MSS providers to address these issues. The U.S. Coast Guard (Coast Guard) states that it will depend increasingly on 9-1-1-type services and caller ID for its SAR operations and to prevent hoaxes. It requests, therefore, that Big LEO systems be required to provide standard location and caller ID information.[268] Several commenters expressed similar opinions stating, generally, that the Commission should require that Big LEO systems be required to provide standardized information that would identify the calling party, give the calling party's location and route emergency messages to an appropriate emergency organization.[269] The Interagency Committee for Search and Rescue[270] (ICSAR) noted all proposed Big LEO providers had stated that their systems will be available for distress and

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transmitting messages related to dangers to navigation.

[265] For example, the Interagency Committee on Search and Rescue (ICSAR) is composed of representatives from seven Federal Agencies, including the FCC, and has search and rescue responsibilities in the United States. Any satellite operator offering emergency services within the United States should coordinate the establishment of emergency services and procedures for its use with this organization. Similar procedures should be developed with all other domestic and international search and rescue organizations so that coordinated rescue operations can be quickly effected in the geographic area of concern.

[266] Trudell Comments at 4.

[267] Id at 2.

[268] Coast Guard Comments at 1.

[269] See, e.g., Comments of the National Association of EMS Physicians at 1; Comments of the Texas Advisory Commission on State Emergency Communications at 2, Reply Comments at 2; Reply Comments of the National Institute for Urban Search and Rescue at 2 and 3; and Reply Comments of the National Emergency Number Association at 3.

[270] ICSAR is made up of representatives from seven Federal agencies including the Federal Communications Commission. This Committee has search and rescue responsibilities under the United States National Search and Rescue Plan.

safety communications and recommends that the Commission develop requirements to ensure that MSS systems meet public safety needs.[271] ICSAR also recommends that these issues -- standardized location, caller ID and routing of emergency or distress calls -- be addressed in a separate rule making.[272] The National Emergency Number Association states that the Commission should adopt a rule to require that licensees of Big LEO systems cooperate in the provision of National Security and Emergency Preparedness (NS/EP) communications.[273]

198. LQP states that it supports the Commission's proposed rule regarding distress and safety communications and in principle its obligation regarding distress communications, but opposes having to provide search and rescue or disaster response communications as a general service offering.[274] LQP stated that the Commission should follow its decision reached in the Little LEO proceeding.[275] Motorola states that it does not object to the proposed rule and notes that consistent with the Commission's decision in the Little LEO proceeding, the Commission did not intend to require that Big LEO MSS licensees show specific means of interconnection to route distress calls and did not intend for Big LEO MSS stations to be used in lieu of emergency beacons required to be carried by international agreement or statute.[276] Motorola strongly opposes the imposition of a specific technical model for the 9-1-1 interconnection and location information delivery.[277]

199. Many of the Big LEO applicants acknowledge that they may carry distress and safety or disaster response communications. They argue that this would be, however, no different than the capability of cellular radios today or future personal communications services that may be used in the event of a distress or an emergency. In the Notice, we reminded licensees of their obligations under the Communications Act regarding distress communications and noted the potential for such systems to complement existing services, but, also recognized that Big LEO systems are not intended to replace existing international safety services. Further, the Commission has begun to examine matters related to enhanced 9-1-1 capability including position

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[271] ICSAR Reply Comments at 2.

[272] Id. See also Summary of Pertinent Comments attached to ICSAR's Reply Comments for a summary of issues.

[273] National Communications System Comments at 2.

[274] LQP Comments at 116, Reply Comments at 94. See also Comments of TRW at 193 and Constellation Reply Comments at 54.

[275] See NVNG MSS Order, note 48, supra, at 8458.

[276] Motorola Comments at 68.

[277] See Motorola Reply Comments at 54-55.

location in PCS, cellular and other mobile services in a recently initiated rule making.[278] We are, therefore, denying commenters requests that the Commission require caller ID, standardized position information and automatic routing for distress and safety communications or disaster response communications. We will address those issues in our rulemaking proceeding on enhanced 9-1-1 capability,[279] and we will adopt section 25.143(f) substantially as proposed.

200. We also noted, however, that we expected any satellite licensee that chose to offer emergency or safety communications to coordinate with appropriate SAR organizations.[280] No commenters opposed this suggestion and we are adding it to the proposed rule.

201. Comsat states that because of the critical nature of distress and safety communications to the maritime community and the extensive international effort that is underway to implement the Global Maritime Distress and Safety System (GMDSS),[281] the Commission should determine the extent to which applicants for Big LEO systems will provide distress and safety communications and participate in the GMDSS.[282] Mobile Datacom requests clarification of the proposed requirement for position determination capability for Big LEO systems related to distress communications.[283] Specifically, it requests that the Commission clarify whether Big LEO systems will be permitted to arrange for radio determination satellite service (RDSS) from companies such as Mobile Datacom.[284]

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[278] See Second Report and Order, Gen. Docket No. 90-314, 8 FCC Rcd 7700 (1993), at para. 139. Notice of Proposed Rulemaking in CC Docket No. 94-102, FCC 94-237 (adopted September 19, 1994) (Enhanced 9-1-1 Notice).

[279] Id.

[280] See Notice, note 2, supra, at para. 86.

[281] Certain U.S. ships are required to carry radio equipment. Carriage requirements are established by statute, treaty and in the Commission's Rules. See, Sections 351 through 386 of the Communications Act of 1934, 47 U.S.C. §§ 351-386; Amendments to the 1974 SOLAS Convention concerning Radiocommunications for the Global Maritime Distress and Safety System, Ch. IV, International Convention for the Safety of Life at Sea, 32 U.S.T. 47, T.I.A.S. 9700 (1974); and subparts Q, R, S, T and W of the Commission's Rules, 47 C.F.R. subparts Q, R, S, T and W.

[282] COMSAT Comments at 14.

[283] Mobile Datacom apparently believes that the Commission proposed a requirement for position information because of the requirements in the Communications Act related to distress and safety communications. The proposed requirement for position information is, however, related to interference protection for the radio astronomy service.

[284] Mobile Datacom Comments at 14.

202. As we noted in paragraph 86 of the Notice, Big LEO systems may not be used in lieu of emergency beacons required to be carried by statute or treaty. In response to Comsat's request, we note that Big LEO systems cannot now be used to comply with the requirements of the GMDSS. The requirements for GMDSS equipment and the approval process are contained in Sections 80.1101 and 80.1103, respectively, of the Commission's Rules.[285] There are, however, no restrictions prohibiting any Big LEO system from carrying distress and safety communications on an ancillary basis. Finally, in response to Mobile Datacom's request for clarification of whether position determination information can be supplied by an RDSS licensee, we proposed that Big LEO systems be capable of determining the position of a user transceiver, but did not specify how licensees have to derive the position information. We believe that decision is best left to the system provider. In conclusion, we are clarifying the language in Section 25.143(f) regarding a licensee's responsibility to protect distress communications and to make clear that although it is the licensee's responsibility to determine position information of transceivers that we are not prescribing how this must be accomplished.[286]

6. Other Requirements

203. As proposed in the Notice and without objection from any interested parties, we will adopt a specific rule that prohibits any licensee from selling a bare license for a profit.[287] This provision is critical to discourage speculators and to prevent unjust enrichment of those who do not implement their proposed systems. This provision is not intended to prevent the infusion of capital by either debt or equity financing, but any such transaction will be monitored to ensure that it does not constitute an evasion of our anti-trafficking provision.[288] This rule, however, will not apply if auctions are implemented. It is not intended to prohibit applicants who obtain licenses by competitive bidding from negotiating post-auction resale transactions.[289]

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[285] See 47 C.F.R. §§ 80.1101 and 80.1103.

[286] TRW states that Big LEO system licensees operating on U.S. territorial waters are required to give priority to distress communications. See TRW Comments at 194. Motorola stated that the requirements of proposed rule section 25.143(f) would apply only for MSS stations used to comply with an international agreement or statute. See Motorola Comments at 68 and Reply Comments at 58.

[287] See Notice, note 2, supra, at para. 84.

[288] Motorola is concerned that one applicant might prop up another simply to guarantee access to the maximum possible spectrum by CDMA operations. This concern can be appropriately addressed as a real party in interest question if the issue arises. Motorola's speculation about a possible future occurrence does not warrant further consideration or action at this time.

[289] See para. 96, supra.

204. In the Notice, we also requested comment on whether any additional public service requirements should be imposed on Big LEO licensees. Those favoring such a requirement were instructed to provide an analysis of the utility of Big LEO systems to provide these services and an analysis of the existing systems used to provide these services, including their costs. Several commenters recognize the important potential of MSS for educational and public service uses.[290] The Corporation for Public Broadcasting (CPB), for example, discusses the promise of Big LEO systems to provide educational services to those in remote areas and to allow users throughout the world to take "electronic field trips." CPB urges that to ensure public access to these services, the Commission should require licensees to make their systems available to educators and students at preferential rates. It further argues that even if the Commission does not mandate a rate preference in this proceeding, it should consider imposing such a requirement in a variety of other services.

205. None of the LEO applicants supports a mandatory service or preferential rate requirement. Ellipsat notes that MSS systems are unsuitable for providing the envisioned services. According to Ellipsat, Big LEO systems have inherently low data rates and cannot supply the high bandwidth required to support the contemplated educational services without drastically absorbing MSS capacity.[291] Motorola further argues that requiring Big LEO operators to dedicate a portion of their capacity to non-revenue generating activities would unduly constrain MSS systems and would handicap them in their ability to compete with other wireless services and with foreign MSS providers.[292] TRW and Motorola argue that none of the proponents of such a requirement have provided a detailed analysis of existing systems and costs, as required. In the absence of this analysis, they conclude that there is no basis upon which the Commission could impose public service requirements.[293]

206. In light of the service hardships alleged by the system proponents, we believe that a strong demonstration of need and feasibility is required prior to adopting specific public service requirements for Big LEO systems. We agree with Motorola and TRW that there is not sufficient information in this record to support such requirements at this time.

207. The National Communication Systems (NCS) believes that Big LEO licensees should be required to cooperate in providing national security/emergency preparedness services (NS/EP) and that any discussion of technical requirements for Big LEO systems should address survivable and endurable communications. NCS does not propose specific rules but instead

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[290] See Joint Comments of the Association of America's Public Television Stations and Public Broadcasting Service at 2; Comments of National Public Radio at 2; Comments of the Corporation for Public Broadcasting at 2-3.

[291] Ellipsat Reply Comments at 36.

[292] Motorola Reply Comments at 58.

[293] TRW Reply Comments at 95; Motorola Reply Comments at 59.

requests that the Commission consider these issues in its report and order. We note that the Commission has chartered a federal advisory committee, the Network Reliability Council (NRC), to consider whether and to what extent essential services, including emergency 9-1-1 service, health, safety and other emergency communications services, are compromised during network outages.[294] The NRC agreed that national security would be included within the topic of emergency services pursuant to its charter.[295] We further note that on September 19, 1994 the Commission adopted a Notice of Inquiry requesting comment on the extent to which mobile radio services, including LEO MSS, should be required to meet compatibility requirements with 9-1-1 services.[296] The Commission will consider issues regarding the availability of reliable emergency services in these proceedings.

## F. Mobile Earth Station Licensing

208. In the Notice, the Commission proposed a licensing procedure for the earth station segment of the satellite system. We indicated that the ground segment will be comprised of central fixed-earth "gateway" stations operating in the feeder link frequency bands, mobile user transceiver units operating in the mobile satellite frequency bands, and tracking, telemetry and command (TT&C) earth stations operating in either the feeder link, mobile service or space bands. We proposed to license gateway and TT&C stations as fixed-satellite earth stations under Part 25. In addition, we proposed a blanket licensing approach for the user transceivers. Under this approach, a service vendor, which may or may not be the space station licensee, would hold the authorization and would be responsible for a specified number of technically identical transceiver units. Blanket applications would include a demonstration that the operation of transceivers will not interfere with other authorized users. License term would be ten years from date of grant and requests for additional units would be treated as minor license modifications.[297] In addition, we proposed that an end user be required to obtain authorization of the space station operator before the user may transmit to that system and, that once access authority is obtained, the operations of that transceiver would fall under the blanket earth station license of the space station operator or the vendor. Our proposed rules would not preclude bilateral, government-to-government discussions regarding international roaming arrangements. They would also permit roaming into the United States by users having technically compatible transceivers designed to operate with U.S. licensed systems and once authorized to access a U.S. system, a roaming user's transceiver operations would fall within the blanket license of the satellite operator or the service

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[294] See 59 FR 31246 (June 17, 1994).

[295] See Minutes of the Network Reliability Council Meeting, July 6, 1994.

[296] See Enhanced 9-1-1 Notice, note 278, supra.

[297] See proposed Sections 25.115(d), 25.130(b), 25.133(b), 25.136, and 25.213.

vendor. The regulatory treatment of earth station licensees providing commercial mobile radio services would be as common carriers.[298]

209. The comments received in response to our proposals were favorable[299] and thus we will adopt the rules substantially as proposed. Constellation and Motorola, suggested several minor clarifications to the final rules and we will adopt these suggestions.[300] We will not, however, adopt at this time a complete revision of § 25.115, Applications for Earth Station Authorizations, as suggested by Motorola. If experience with these licensing procedures indicates that this rule, as it applies to the Big LEO service, needs to be amended, we will consider doing so at a later time.[301]

## G. International Issues

### 1. Coordination

210. As we stated in the Notice, non-geostationary mobile satellites, in their orbits around the world, will pass over all countries. Because these systems provide global coverage, each will require global coordination. As with all satellite services, each Big LEO applicant and licensee will be required to provide the Commission with all information necessary for advance publication, coordination, and notification of frequency assignments pursuant to the international Radio Regulations and for consultation pursuant to Article 14 of the INTELSAT Agreement and Article 8 of the INMARSAT Convention.[302]

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[298] See Notice, note 2, supra, at paras. 88-90.

[299] See, e.g., Comments of TRW, Inc. and Comsat Corporation.

[300] These include adding to § 25.115(d)(3) the words "if not already licensed under this subpart" to clarify that gateway, TT&C and Network Control earth stations can be licensed under other procedures; adding to § 25.120(e) language relating to renewals and cut-off periods; clarifying § 25.136(b) to distinguish between authorization of a particular unit and use of the system; clarifying § 25.130(b) to recognize specific procedures for NVNG MSS transceiver units; and clarifying § 25.136(a) to include cockpit communications.

[301] Other than Section 25.213(b), we will not adopt specific technical requirements for Big LEO transceivers at this time. These requirements are being considered in domestic and international fora and will be codified, if necessary, when earth station applications have been filed. We note that user transceivers will be required to comply with all applicable domestic and international standards governing their operations, including the radiofrequency radiation levels recommended by the American National Standards Institute (ANSI). See 47 C.F.R. § 1.1.1307(b).

[302] See 47 C.F.R. § 25.111(b).

211. Furthermore, the ITU (WARC-92) has adopted Resolution 46 to govern the coordination of mobile satellite systems in this frequency band. This procedure assures that worldwide coordination is accomplished in a manner that requires both the administration proposing the system and the administration that is affected by the planned system to cooperate in resolving coordination difficulties.[303] We agree with LQP and TRW that successful coordination under Resolution 46 is not a prerequisite for licensing, launching and operating these systems.[304] We note, however, that until they successfully complete coordination they cannot cause harmful interference to other primary services operating in these frequency bands, nor can they claim protection. We, however, will follow the coordination procedures prescribed by the ITU and will work with the global community to promote mobile satellite services through the development of sharing techniques and the exploration of other technical issues.[305] Moreover, as we stated in our Notice, we will continue to require our licensees to meet both their international obligations and any national requirements imposed by other licensing administrations regarding operations within their territories.[306] We continue to believe that decisions relating to the implementation of Big LEO service within a country's territory will remain within that country's jurisdiction and control.

212. In the Joint Proposal, the parties state that the Commission should establish a global band segmentation sharing plan different than the spectrum domestic spectrum plan. Specifically, the parties state that outside of North America, CDMA MSS licensees should be limited to operating their systems over 9.75 MHz of spectrum at 1610-1619.75 MHz and that the TDMA MSS licensee should be limited to operating its system over 6.75 MHz of spectrum at 1619.75 - 1626.5 MHz. According to the Joint Proposal, all U.S. international coordination activity should be based either on the domestic band segmentation plan we are adopting today, or, outside North America, on the proposed global plan. In addition, the parties to the Joint Proposal request the Commission to prohibit MSS licensees from seeking or accepting an exclusive assignment in the 1.6 GHz band that would preclude other MSS systems from providing service in any foreign country. LQP objects to these proposals, stating that they could be construed as preempting other nations' sovereign decisions.

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[303] ITU Resolution No. 46 (WARC-92, Res.46) states that "[a]ffected administrations, as well as the administration seeking coordination, shall make all possible mutual efforts to overcome the difficulties in a manner acceptable to the parties concerned."

[304] See LQP Comments at 117 and TRW Comments at 196. However, as we stated in our Notice, if a licensee has not completed coordination prior to launch, it must operate on a non-interference basis with respect to authorized users. See international Radio Regulation (RR) 342.

[305] Indeed, the United States participates actively in ITU-R Study Groups 2, 4 and 8, all of which are examining issues that address sharing and coordination of MSS systems.

[306] To the extent a licensee does not desire to meet a national requirement of a licensing administration within its territory, it may refrain from providing service to that particular administration. See TRW Comments at 196.

213. We will not impose a global band sharing plan on U.S. licensees at this time. The four parties to the Joint Proposal have not given any justification for doing so, and one applicant specifically opposes the imposition of such a plan. We have no evidence on the record before us of imminent coordination conflicts among the applicants beyond U.S. borders. Neither is it clear at present that operating constraints designed to accommodate our domestic licensees will provide either necessary or effective in other jurisdictions. Perhaps most importantly, we do not believe it is appropriate for the United States to impose global band sharing restrictions, that directly impact the ability of other countries to access these systems as they see fit, absent indications from these countries regarding their planned use of these frequency bands. Accordingly, we will not mandate a band sharing scheme to be followed beyond U.S. borders.

2. EC Concerns

214. The Delegation of the European Commission (EC) is concerned that the proposals in the Notice are based purely upon domestic U.S. interests despite the global nature of the proposed systems and services. Specifically, the EC alleges that the Notice: (1) fails to take into account proposed non-U.S. or future systems, their access to the U.S. market and use of spectrum in the U.S.; (2) indicates an intention to extend Section 310 restrictions to the proposed systems inhibiting potential European investment; (3) advances trade and industrial policy arguments underlining the importance of the proposed systems to the U.S. economy and U.S. leadership; (4) proposes unilateral solutions to orbit, frequency and coverage issues that are global in nature; (5) fails to discuss requirements to effect the satisfactory application of Resolutions 46 and 70 of WARC-92; and (6) fails to address issues related to access to the 2 GHz band. The EC states that the regulatory approach that we proposed raises global regulatory and trade issues and that the U.S. should not proceed with its domestic licensing process until it consults with foreign administrations.

215. We agree that the proposed systems have international ramifications. Many of these are or will be addressed in appropriate international fora and in ITU satellite coordination activities. Others may be appropriate for bilateral consultations of the nature sought by the EC. However, we do not agree that the U.S. domestic licensing process must await final resolution of these issues.

216. We find delaying the U.S. licensing process is unacceptable. Delaying our regulatory process would delay the improved communications and economic growth that Big LEO services will create. These benefits would be developed both for citizens of the United States and all other countries that may choose to participate in rendering these services. Such a delay would also harm developing countries by limiting their opportunity to improve their communications infrastructure. The uncertainty associated with delay could also adversely impact the viability of the proposed systems in the financial markets and the ability of the applicants to attract additional investors. U.S. applicants have already invested significant resources in research and development, satellite design, marketing and participation in ITU meetings and conferences. Even if the United States were to delay its licensing process, it is unclear how the EC proposes to resolve the issues it has identified, resulting in open-ended delay. Further, the

EC's criticism of our proposals is not accompanied by recommendations. Indeed, it is not clear that the EC is yet in a position to speak authoritatively for its member countries. We do not believe that an indefinite delay in the U.S. regulatory process under such circumstances is warranted.

217. It is also clear that there we do not need to delay the domestic licensing proceeding until international agreements are finalized. Regardless of our domestic decisions, each administration will retain the right to license gateway earth stations and mobile earth stations needed to provide service. In addition, U.S. licensees will be subject to ITU recommendations and coordination procedures. Further, the United States is working within the ITU Radiocommunications sector to develop standards applicable to LEO systems. However, we seek to leave system design and service offerings to the licensees as much as possible in order to encourage technological innovation, to promote rapid implementation of Big LEO services and to maximize consumer choice. Therefore it is in the interest of the United States' government and U.S. system operators to seek globally acceptable standards and we will strive to do so. We disagree with the EC that we are not taking into account projects envisaged outside the United States and future global systems that might use the spectrum. In the Notice, we noted that all U.S. satellite systems are subject to ITU coordination procedures.[307] Thus, U.S.-licensed operators are required to coordinate their proposed systems with countries whose existing services, or whose possible future MSS systems, might be affected. Regardless of the spectrum licensing arrangement within the United States, we would work with affected administrations to resolve any spectrum sharing or technical issues. Further, we are not precluding access to the the U.S. market. We believe, however, that subject is more appropriately handled through bilateral discussions (as the EC contemplates) and the ITU coordination process.

218. In addition, we are not seeking to extend Section 310 restrictions on the proposed systems with the intention of inhibiting European investment. In fact, Section 310(b) restrictions will not necessarily apply to the systems because we are not requiring them to operate on a common carrier basis.[308] This policy will permit investment by European industry and other non-government interests. Some of the proposed systems already anticipate significant non-U.S. investment and continue to seek additional such participation. We recognize multinational participation as an integral part of developing a global system.

219. With regard to the EC's concern that we are advancing trade and industrial policy arguments by moving ahead with the proposed systems, we note that a report prepared by PKMG Peat Marwick on behalf of the European Commission suggests that (with regard to Europe), "...the immediate priority is international trade and policy issues;"[309] the very issues the EC

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[307] Notice, note 2, supra, at para. 91.

[308] See paras. 171-181, supra.

[309] See "Satellite Personal Communications and their Consequences for European Telecommunications Trade and Industry," KPMG Peat Marwick, at 4, emphasis added.

accuses the United States of advancing. Notwithstanding the EC's views, the United States has every right under established ITU procedures to move forward with licensing systems that are necessary to satisfy domestic demand for new communication services. Other administrations have the right to decide whether these or any other non-U.S. licensed systems will operate in their countries and whether to participate in the provision of services. Participation in providing these MSS services will give their industries the opportunity to share in the global economic benefits we believe these systems will bring.

220. The EC also argues that the Notice proposes unilateral solutions to orbit, frequency and coverage issues that have global implications. Further, it contends that the Notice fails to discuss requirements necessary to effect the application of ITU Resolution Nos. 46 and 70.

221. With regard to orbit considerations[310] and the use of 1.6/2.4 GHz frequencies, we note that as a matter of course the United States engages in good faith negotiations with respect to whatever non-U.S. systems have been filed with the ITU at the time U.S. systems are ready to begin coordination.[311] Consequently, the use of the orbits and of frequencies by U.S.-licensed systems will be subject to the outcome of the ITU coordination process. The worldwide coverage conditions proposed in the Notice[312] result from our desire that these systems be capable of providing coverage to all areas of the world. This could further U.S. participation in the global information infrastructure and potentially benefit developing countries. Again, however, whether U.S.-licensed systems provide services outside the United States would be subject to the agreement of and authorization by other administrations.

222. With regard to the application of Resolutions No. 46 and 70, we note that Resolution No. 46 relates to "interim" procedures for the coordination and notification of non-geostationary satellite networks. As an interim procedure it is subject to further development and will likely evolve. Nevertheless, U.S.-licensed systems will be subject to whatever coordination procedures are in effect at the time, including Resolution 46 or its successor. In the Notice we stated explicitly that we would follow coordination procedures prescribed by the ITU, and in fact we reference Resolution No. 46 and its applicability to Big LEO systems.[313] We also note that each Big LEO applicant will be required to provide us all information necessary to

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[310] We assume here that the EC refers to non-geostationary vs. geostationary orbits.

[311] We note that the following administrations have proposed MSS systems in the 1.6/2.4 GHz bands that have been advance published, coordinated or notified with the ITU: France (2 systems); Germany; INMARSAT; Russian Federation (2 systems); Tonga (4 systems); and the United States (2 systems).

[312] Notice, note 2, supra, at para. 23.

[313] Notice, note 2, supra, at para. 92 and n. 149.

advance publish, notify and coordinate their proposed systems. Implicitly, all applicants will be required to assist us in effecting whatever coordination procedures the ITU requires.[314]

223. On the other hand, Resolution 70 relates to "establishment" of standards for low-orbit satellite systems and has no requirements per se. It seeks to begin the process of establishing standards for low-orbit satellite systems and invites the appropriate ITU organs to begin studies in this regard. The United States participates in these ITU activities and will continue to do so. However, as Resolution No. 70 has not resulted in any specific ITU recommendations, it is not possible to address "requirements" in a domestic licensing proceeding.

224. Finally, the EC contends that the Notice fails to address issues related to access to 2 GHz MSS bands[315] and the relation between access to those bands and the bands under consideration here. First, we note that the 2 GHz bands have not yet been allocated for MSS in the United States. Therefore, these bands will be the subject of another proceeding. In such a proceeding, all matters relevant to the use of 2 GHz bands would be discussed. Nevertheless, we note the increasing demand for access to MSS spectrum worldwide and the potential value of the 2 GHz bands for the provision of MSS. We are also aware of proposals to use the 2 GHz bands for services similar and competitive to those envisaged by the Big LEO applicants.[316] The United States would like to facilitate access to these bands, as does the EC. We believe that WRC-95 and future multi-lateral consultations would present the appropriate fora to discuss access to and use of 2 GHz MSS bands.

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[314] This requirement applies to all FCC-licensed satellite systems and is codified in the FCC rules. See 47 CFR § 25.111(b).

[315] The "2 GHz" MSS bands were allocated at WARC-92 as follows:

1970-1980 MHz and 2160-2170 MHz:
(Regions 1 and 3) - Fixed, Mobile;
(Region 2) - Fixed, Mobile, Mobile-Satellite*

1980-2010 MHz and 2170-2200 MHz:
(Regions 1, 2 and 3) -- Fixed, Mobile, Mobile-Satellite*

* These MSS allocations are available for use after Jan. 1, 2005, except in the U.S., when they will be available after Jan. 1, 1996.

[316] For example, the FCC has received two petitions (names) to provide MSS services in this range. In addition, spectrum in this range has been identified for a satellite component of FLMPTS.

## IV. FINAL REGULATORY FLEXIBILITY ANALYSIS

225. Need for Rules and Objective. We have codified proposed rules that will permit Big LEO systems to be licensed. Our objectives have been to promote efficiency and innovation in the licensing and use of the electromagnetic spectrum, to develop competitive and innovative communications systems, and to promote effective and adaptive regulations.

226. Issues Raised by the Public in Response to the Initial Analysis. No comments were received specifically in response to the Initial Regulatory Flexibility Analysis. We have, however, taken into account all issues raised by the public in response to the proposed rules. In certain instances, we have eliminated or modified our proposed rules in response to those comments.

227. Alternatives that would Lessen Impact. The minimal regulatory burden that we have imposed is necessary in order to carry out our duties under the Communications Act and other Federal statutes. We will continue to examine these requirements in an effort to eliminate unnecessary regulations and to minimize significant economic impact on small businesses.

## V. CONCLUSION AND ORDERING CLAUSES

228. By our action today, we are adopting regulations that will allow the licensing of competitive voice and data Big LEO systems. This service has the potential to provide the United States public with a wide range of needed mobile voice services and to help stimulate the domestic economy as these multi-billion dollar systems are implemented in the United States and throughout the world.

229. Accordingly, IT IS ORDERED that Parts 25 and 92 of the Commission's rules are amended as specified in Appendix B, effective 30 days after publication in the Federal Register.

230. IT IS FURTHER ORDERED that the applicants will be required to file conforming amendments and all necessary fees no later than November 16, 1994 for continued consideration in this processing group.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton
Acting Secretary

Appendix A

**Comments/Petitions:**

1. Aeronautical Radio, Inc. & The Air Transport Association of America
2. AirTouch Communications
3. AMSC Subsidiary Corporation
4. Association of America's Public Television Stations, & Public Broadcasting Service
5. Barclays de Zoete Wedd Limited
6. Committee On Radio Frequencies, Natl Research Council for the Natl Academy of Sciences
7. COMSAT Mobile Communications
8. Constellation Communications, Inc.
9. Conus Communications Company Limited Partnership
10. Corporation for Public Broadcasting
11. Defense Information Systems Agency (National Communications System)
12. Eastman Kodak Company
13. Ellipsat Corporation
14. EMSAT: Advanced Technology for Emergency Medical Services
15. Fairchild Space and Defense Corporation
16. Federal Aviation Administration
17. Harris Corporation
18. Loral/QUALCOMM Partnership, L.P. (Comments + Technical Appendix)
19. Mobile Datacom Corporation
20. Motorola, Inc.
21. Mr. Bernard J. Trudell
22. National Association of EMS Physicians
23. National Astronomy and Ionosphere Center, Arecibo Observatory
24. National Telephone Cooperative Association
25. National Public Radio, Inc.
26. NOVACOM, Inc.
27. Rockwell International Corporation
28. State of Hawaii, Department of Business, Economic Development & Tourism
29. Texas Advisory Committee on State Emergency Communications
30. TRW Inc.
31. United States Coast Guard, U.S. Department of Transportation
32. Westinghouse Electric Corporation
33. Wireless Cable Association International, Inc., The

**Reply Comments:**

1. Aeronautical Radio, Inc. and The Air Transport Association of America

2. AirTouch Communications
3. AMSC Subsidiary Corporation
4. Arizona Board of Regents for the Benefit of the University of Arizona, et. al. (ITFS Parties)
5. Committee on Radio Frequencies (Natl Research Council for the Natl Academy of Sciences)
6. Constellation Communications, Inc.
7. Ellipsat Corporation
8. Interagency Committee on Search and Rescue (DOT, United States Coast Guard)
9. Loral/Qualcomm Partnership, L.P.
10. Mobile Datacom Corporation
11. Motorola Satellite Communications, Inc.
12. National Institute for Urban Search and Rescue
13. National Business Aircraft Association, Inc.
14. National Emergency Number Association
15. Newcomb Communications, Inc.
16. Texas Advisory Committee on State Emergency Communications
17. TRW Inc.
18. Wireless Cable Association International, Inc.

APPENDIX B

Title 47 of the Code of Federal Regulations, Parts 2, 25 and 94, are amended as follows:

1. The Table of Contents for Part 25 is revised to read as follows:

## PART 25 - SATELLITE COMMUNICATIONS

### Subpart A - General

Sec.


25.101 Basis and scope.

25.102 Station authorization required.

25.103 Definitions.

25.104 Preemption of local zoning of earth stations.

25.105 - 25.108 [Reserved]

25.109 Cross-reference.


### Subpart B - Applications and Licenses


25.110 Filing of applications, fees, and number of copies.

25.111 Additional information.

25.112 Defective applications.

25.113 Construction permits.

25.114 Applications for space station authorizations.

25.115 Applications for earth station authorizations.

25.116 Amendments to applications.

25.117 Modification of station license.

25.118 Assignment or transfer of control of station authorization.

25.119 Application for special temporary authorization.

25.120 License term and renewals.

**EARTH STATIONS**

25.130 Filing requirements for transmitting earth stations.

25.131 Filing requirements for receive-only earth stations.

25.132 Verification of earth station antenna performance standards.

25.133 Period of construction; certification of commencement of operation.

25.134 Licensing provisions of very small aperture terminal (VSAT) networks.

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2. The authority citation for Part 25 continues to read as follows:

**AUTHORITY: Sections 101 - 404, 76 Stat. 419 - 427; 47 U.S.C. 701 -744, Sec. 4, 48 Stat. 1066, as amended; 47 U.S.C. 154. Interprets or applies sec. 303, 48 Stat. 1082, as amended; 47 U.S.C. 303.**

3. Section 25.114 is amended by revising paragraphs (c)(6), (c)(18), and (c)(26), and adding new paragraphs (c)(28) and (d), to read as follows:

**§ 25.114 Applications for space station authorizations.**

* * * * *

(c) * * *

(6) (i) For geostationary satellite orbit satellites, orbital location, or locations if alternatives are proposed, requested for the satellite, the factors which support such an orbital assignment, the range of orbital locations from which adequate service can be provided and the basis for determining that range of orbital locations, and a detailed explanation of all factors that would limit the orbital arc over which the satellite could adequately serve its expected users.

(ii) For non-geostationary satellite orbit satellites, the number of space stations and applicable information relating to the number of orbital planes, the inclination of the orbital plane(s), the orbital period, the apogee, the perigee, the argument(s) of perigee, active service arc(s), and right ascension of the ascending node(s).

(iii) For 1.6/2.4 GHz Mobile-Satellite Service space stations, the feeder link frequencies requested for the satellite, together with the demonstration required by §§ 25.203(j) and (k).

* * * * *

(18) Detailed information demonstrating the financial qualifications of the applicant to construct and launch the proposed satellites. Applications for domestic fixed-satellite systems and mobile-satellite systems shall provide the financial information required by § 25.140(b)-(e), § 25.142(a)(4), or § 25.143(b)(3), as appropriate. Applications for international satellite systems authorized pursuant to Establishing of Satellite Systems Providing International Communications, 50 FR 42266 (October 18, 1985), 101 FCC 2d 1046 (1985), recon. 61 RR 2d 649 (1986), further recon. 1 FCC Rcd 439 (1986), shall provide the information required by that decision.

* * * * *

(26) Applications for authorizations in the Mobile-Satellite Service in the 1545-1559/1646.5-1660.5 MHz frequency bands shall also provide all information necessary to comply with the policies and procedures set forth in Rules and Policies Pertaining to the Use of Radio Frequencies in a Land Mobile Satellite Service, 52 FR 4017 (Feb. 9, 1987), 2 FCC Rcd 485 (1987).

* * * * *

(28) Applications for authorizations in the 1.6/2.4 GHz Mobile-Satellite Service shall also provide all information specified in § 25.143.

(d) Applicants requesting authority to construct and/or launch a system comprised of technically identical, non-geostationary satellite orbit mobile-satellite service space stations may file a single "blanket" application containing the information specified in paragraph (c) of this section for each representative space station.

4. Section 25.115 is amended by revising paragraph (d) to read as follows:

**§ 25.115 Applications for earth station authorizations.**

* * * * *

(d) User transceivers in the NVNG and 1.6/2.4 GHz Mobile-Satellite Service need not be individually licensed. Service vendors may file blanket applications for transceiver units using FCC Form 493 and specifying the number of units to be covered by the blanket license. Each application for a blanket license under this section shall include the following:

(1) A general narrative section describing the applicant and the overall system operation,

(2) A Form 430 (Licensee Qualification Report), if not already on file in conjunction with other facilities licensed under this subpart,

(3) A Form 493 for each representative type of user transceiver terminal unit,

(4) A designation of a point of contact where records of individual users will be maintained.

In addition, applicants in the NVNG MSS service shall provide the information described in § 25.135. Applicants in the 1.6/2.4 GHz Mobile-Satellite Service shall demonstrate that the stations comply with the technical requirements specified in § 25.213.

5. Section 25.120 is amended by revising paragraphs (d) and (e) to read as follows:

**§ 25.120 License term and renewals.**

* * * * *

(d) Space stations.

(1) For geostationary satellite orbit satellites, the license term will begin at 3 a.m. EST on the date the licensee certifies to the Commission that the satellite has been successfully placed into orbit and that the operations of the satellite fully conform to the terms and conditions of the space station radio authorization.

(2) For non-geostationary satellite orbit satellites, the license term will begin at 3 a.m. EST on the date that the licensee certifies to the Commission that its initial space station has been successfully placed into orbit and that the operations of that satellite fully conform to the terms and conditions of the space station system authorization. All

space stations launched and brought into service during the ten-year license term shall operate pursuant to the system authorization, and the operating authority for all space stations will terminate upon the expiration of the system license.

(e) Renewal of licenses. Applications for renewals of earth station licenses must be submitted on FCC Form 405 (Application for Renewal of Radio Station License in Specified Services) no earlier than 90 days, and no later than 30 days, before the expiration date of the license. Applications for space station system replacement authorization for non-geostationary orbit satellites shall be filed no earlier than 90 days, and no later than 30 days, prior to the end of the seventh year of the existing license term.

6. Section 25.130 is amended by revising paragraph (b) to read as follows:

**§ 25.130 Filing requirements for transmitting earth stations.**

* * * * *

(b) A frequency coordination analysis in accordance with §25.203 shall be provided for earth stations transmitting in the frequency bands shared with equal rights between terrestrial and space services, except that applications for user transceiver units associated with the NVNG mobile-satellite service shall instead provide the information required by § 25.135 and applications for user transceiver units associated with the 1.6/2.4 GHz Mobile-Satellite Service shall demonstrate that user transceiver operations comply with the requirements set forth in § 25.213.

7. Section 25.133 is amended by revising paragraph (b) to read as follows:

**§ 25.133 Period of construction; certification of commencement of operation.**

* * * * *

(b) Each license for a transmitting earth station included in this part shall also specify as a condition therein that upon the completion of construction, each licensee must file with the Commission a certification containing the following information: The name of the licensee; file number of the application; call sign of the antenna; date of the license; a certification that the facility as authorized has been completed and that each antenna facility has been tested and is within 2 dB of the pattern specified in § 25.209, § 25.135 (NVNG MSS earth stations), or § 25.213 (1.6/2.4 GHz Mobile-Satellite Service earth stations); the date on which the station became operational; and a statement that the station will remain operational during the license period unless the license is submitted for cancellation. For stations authorized under § 25.115(c) of this part (Large Networks of Small Antennas operating in the 12/14 GHz bands) and § 25.115(d) of this part (User Transceivers in the Mobile-Satellite Service), a certificate must be filed when the network is put into operation.

8. A new section 25.136 is added to read as follows:

**§ 25.136 Operating provisions for earth station networks in the 1.6/2.4 GHz mobile-satellite service**

In addition to the technical requirements specified in § 25.213, earth stations operating in the 1.6/2.4 GHz Mobile-Satellite Service are subject to the following operating conditions:

(a) User transceiver units associated with the 1.6/2.4 GHz Mobile-Satellite service may not be operated on civil aircraft unless the earth station has a direct physical connection to the aircraft Cabin Communication system.

(b) User transceiver units in this service are authorized to communicate with and through U.S. authorized space stations only. No person shall transmit to a space station unless the specific transmission is first authorized by the space station licensee or by a service vendor authorized by that licensee.

(c) Any user transceiver unit associated with this service will be deemed, when communicating with a particular 1.6/2.4 GHz Mobile-Satellite Service system pursuant to paragraph (b) of this section, to be temporarily associated with and licensed to the system operator or service vendor holding the blanket earth station license awarded pursuant to Section 25.115(d). The domestic earth station licensee shall, for this temporary period, assume the same licensee responsibility for the user transceiver as if the user transceiver were regularly licensed to it.

9. Section 25.141 is amended by revising paragraphs (a) and (f) to read as follows:

**§ 25.141 Licensing provisions for the radiodetermination satellite service.**

(a) Space station application requirements. Each application for a space station license in the radiodetermination satellite service shall describe in detail the proposed radiodetermination satellite system, setting forth all pertinent technical and operational aspects of the system, including its capability for providing and controlling radiodetermination service on a geographic basis, and the technical, legal and financial qualifications of the applicant. In particular, each application shall include the information specified in Appendix B of Space Station Application Filing Procedures, 93 FCC 2d 1260, 1265 (1983), except that in lieu of demonstrating compliance with item II.F (two degree spacing), applicants are required to demonstrate compatibility with licensed satellite systems in the same frequency band. Applicants must also file information demonstrating compliance with all requirements of this section, specifically including information demonstrating how the applicant has complied or plans to comply with the requirements of paragraph (f) of this section.

* * * * *

(f) Radiodetermination satellite service. Licenses shall coordinate with radiodetermination satellite system licensees to avoid harmful interference to other radiodetermination satellite

systems through (1) power flux density limits; (2) use of pseudorandom-noise codes (for both the satellite-to-user link and for the user-to-satellite link); and (3) random access, time division multiplex techniques. Licensees shall coordinate with 1.6/2.4 GHz Mobile-Satellite Service system licensees to avoid harmful interference to 1.6/2.4 GHz Mobile-Satellite Service systems.

10. A new Section 25.143 is added to read as follows:

**§ 25.143 Licensing provisions for the 1.6/2.4 GHz Mobile-Satellite Service.**

(a) System License: Applicants authorized to construct and launch a system of technically identical non-geostationary satellite orbit satellites will be awarded a single "blanket" license covering a specified number of space stations to operate in a specified number of orbital planes.

(b) Qualification Requirements.

(1) General Requirements: Each application for a space station system authorization in the 1.6/2.4 GHz mobile-satellite service shall describe in detail the proposed satellite system, setting forth all pertinent technical and operational aspects of the system, and the technical, legal, and financial qualifications of the applicant. In particular, each application shall include the information specified in § 25.114.

(2) Technical Qualifications: In addition to providing the information specified in (b)(1), each applicant shall demonstrate the following:

(i) that the proposed system employs a non-geostationary constellation or constellations of satellites;

(ii) that the proposed system be capable of providing mobile satellite services to all locations as far north as 70° latitude and as far south as 55° latitude for at least 75% of every 24-hour period, i.e., that at least one satellite will be visible above the horizon at an elevation angle of at least 5° for at least 18 hours each day within the described geographic area;

(iii) that the proposed system is capable of providing mobile

satellite services on a continuous basis throughout the fifty states, Puerto Rico and the U.S. Virgin Islands, U.S., i.e., that at least one satellite will be visible above the horizon at an elevation angle of at least 5° at all times within the described geographic areas;

(iv) that operations will not cause unacceptable interference to other authorized users of the spectrum. In particular, each application shall demonstrate that the space station(s) comply with the requirements specified in § 25.213.

(3) Financial Qualifications: Each applicant for a space station system authorization in the 1.6/2.4 GHz mobile-satellite service must demonstrate, on the basis of the documentation contained in its application, that it is financially qualified to meet the estimated costs of the construction and launch of all proposed space stations in the system and the estimated operating expenses for one year after the launch of the initial space station. Financial qualifications must be demonstrated in the form specified in §§ 25.140(c) and (d). In addition, applicants relying on current assets or operating income must submit evidence of a management commitment to the proposed satellite system. Failure to make such a showing will result in the dismissal of the application.

(c) Replacement of Space Stations Within the System License Term. Licensees of 1.6/2.4 GHz mobile-satellite systems authorized through a blanket license pursuant to paragraph (a) of this section need not file separate applications to construct, launch and operate technically identical replacement satellites within the term of the system authorization. However, the licensee shall certify to the Commission, at least thirty days prior to launch of such replacement(s) that:

(1) the licensee intends to launch a space station that is technically identical to those authorized in its system authorization, and

(2) launch of this space station will not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

(d) In-Orbit Spares. Licensees need not file separate applications to operate technically identical in-orbit spares authorized as part of the blanket license pursuant to paragraph (a) of this section. However, the licensee shall certify to the Commission, within 10 days of bringing the in-orbit spare into operation, that operation of this space station did not cause

the licensee to exceed the total number of operating space stations authorized by the Commission.

(e) Reporting requirements.

(1) All operators of 1.6/2.4 GHz mobile-satellite systems shall, on June 30 of each year, file with the International Bureau and the Field Office in Laurel, Maryland a report containing the following information:

(i) Status of satellite construction and anticipated launch dates, including any major problems or delays encountered;

(ii) A listing of any non-scheduled space station outages for more than 30 minutes and the cause or causes of the outage;

(iii) A detailed description of the utilization made of the in-orbit satellite system. That description should identify the percentage of time that the system is actually used for U.S. domestic or transborder transmission, the amount of capacity (if any) sold but not in service within U.S. territorial geographic areas, and the amount of unused system capacity; and

(iv) Identification of any space stations not available for service or otherwise not performing to specifications, the cause or causes of these difficulties, and the date any space station was taken out of service or the malfunction identified.

(2) All operators of 1.6/2.4 GHz mobile-satellite systems shall, within 10 days after a required implementation milestone as specified in the system authorization, certify to the Commission by affidavit that the milestone has been met or notify the Commssion by letter that it has not been met. At

its discretion, the Commission may require the submission of additional information (supported by affidavit of a person or persons with knowledge thereof) to demonstrate that the milestone has been met.

(f) Safety and distress communications.

(1) Stations operating in the 1.6/2.4 GHz Mobile-Satellite Service that are voluntarily installed on a U.S. ship or are used to comply with any statute or regulatory equipment carriage requirements may also be subject to the requirements of sections 321(b) and 359 of the Communications Act of 1934. Licensees are advised that these provisions give priority to radio communications or signals relating to ships in distress and prohibits a charge for the transmission of maritime distress calls and related traffic.

(2) Licensees offering distress and safety services should coordinate with the appropriate search and rescue organizations responsible for the licensees service area.

(g) Considerations involving transfer or assignment applications.

(1) "Trafficking" in bare licenses issued pursuant to paragraph (a) of this section is prohibited, except with respect to licenses obtained through a competitive bidding procedure.

(2) The Commission will review a proposed transaction to determine if the circumstances indicate trafficking in licenses whenever applications (except those involving pro forma assignment or transfer of control) for consent to assignment of a license, or for transfer of control of a licensee, involve facilities licensed pursuant to paragraph (a) of this section. At its discretion, the Commission may require the submission of an affirmative, factual showing (supported by affidavits of a person or persons with personal knowledge thereof) to demonstrate that no trafficking has occurred.

(3) If a proposed transfer of radio facilities is incidental to a sale of other facilities or merger of interests, any showing requested under paragraph (g)(2) of this section shall include an additional exhibit which:

(i) Discloses complete details as to the sale of facilities or merger of interests;

(ii) Segregates clearly by an itemized accounting, the amount of consideration involved in the sale of facilities or merger of interests; and

(iii) Demonstrates that the amount of consideration assignable to the facilities or business interests involved represents their fair market value at the time of the transaction.

11. Section 25.201 is amended by adding new paragraphs, in alphabetical order, to read as follows:

**§ 25.201 Definitions.**

* * * * *

Mobile-Satellite Service. A radiocommunication service: (1) Between mobile earth stations and one or more space stations, or between space stations used by this service; or (2) Between mobile earth stations by means of one or more space stations. This service may also include feeder links necessary for its operation. (RR)

* * * * *

1.6/2.4 GHz Mobile-Satellite Service. A mobile-satellite service that operates in the 1610-1626.5 MHz and 2483.5-2500 MHz frequency bands, or in any portion thereof.

* * * * *

12. Section 25.202 is amended by adding new paragraphs (a)(4) and (a)(5) to read as follows:

**§ 25.202. Frequencies, frequency tolerance and emission limitations.**

* * * * *

(a) * * *

(4) The following frequencies are available for use by the 1.6/2.4 GHz Mobile-Satellite Service:

1610-1626.5 MHz:
User-to-Satellite Link
1613.8-1626.5 MHz:
Satellite-to-User Link (secondary)
2483.5-2500 MHz:
Satellite-to-User Link

(5) The following frequencies are available for use by the inter-satellite service:

22.55-23.00 GHz
23.00-23.55 GHz
24.45-24.65 GHz
24.65-24.75 GHz

13. Section 25.203 is amended by revising paragraph (c)(2)(vii) and adding new subsections (j) and (k) to read as follows:

**§ 25.203 Choice of sites and frequencies.**

* * * * *

(c) * * *

(2)(vii) Antenna horizon gain plot(s) determined in accordance with § 25.253(b) for satellite longitude range specified in paragraph (c)(2)(v) of this section, taking into account the provisions of § 25.253(a)(2) for earth stations operating with non-geostationary satellites.

* * * * *

(j) Applicants for non-geostationary 1.6/2.4 GHz Mobile-Satellite Service/ radiodetermination satellite service feeder links shall indicate the frequencies and spacecraft antenna gain contours towards each feeder-link earth station location and will coordinate with licensees of other fixed-satellite service and terrestrial-service systems sharing the band to determine geographic protection areas around each non-geostationary mobile-satellite service/ radiodetermination satellite service feeder link earth station.

(k) An applicant for a non-geostationary 1.6/2.4 GHz Mobile-Satellite Service space station or earth station that will operate with a geostationary satellite or non-geostationary satellite in a shared frequency band in which the non-geostationary system is (or is proposed to be) licensed for feeder links, shall demonstrate in its application that its proposed space or earth station will not cause unacceptable interference to any other satellite network that is

authorized to operate in the same frequency band, or certify that the operations of its space or earth station shall conform to established coordination agreements between the operator(s) of the space station(s) with which the earth station is to communicate and the operator(s) of any other U.S. space station licensed to use the band.

14. Section 25.208 is amended by revising paragraph (c) to read as follows:

**§ 25.208 Power flux density limits.**

(c) In the 17.7-19.7 GHz, 22.55-23.00 GHz, 23.00-23.55 GHz, and 24.45-24.75 GHz frequency bands, the power flux density at the Earth's surface produced by emissions from a space station for all conditions and for all methods of modulation shall not exceed the following values:

-115 dB($W/m^2$) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane.

-115 + 0.5 (d-5) dB ($W/m^2$) in any 1 MHz band for angles of arrival d (in degrees) between 5 and 25 degrees above the horizontal plane.

-105 dB ($W/m^2$) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

15. A new Section 25.213 is added to read as follows:

**§ 25.213 Inter-Service coordination requirements for the 1.6/2.4 GHz Mobile-Satellite Service**

(a) Protection of the radio astronomy service in the 1610.6-1613.8 MHz band against interference from 1.6/2.4 GHz Mobile-Satellite Service systems.

(1) Protection zones. All 1.6/2.4 GHz Mobile-Satellite Service systems shall be capable of determining the position of the user transceivers accessing the space segment through either internal radiodetermination calculations or external sources such as LORAN-C or the Global Positioning System. During periods of radio astronomy observations, land mobile earth stations shall not operate when located within geographic protection zones defined by the radio observatory coordinates and separation distances as follows:

(i) In the band 1610.6-1613.8 MHz, within a 160 km radius of the following radio astronomy sites:

| Observatory | Latitude (DMS) | Longitude (DMS) |
|---|---|---|
| Arecibo, PR | 18 20 46 | 66 45 11 |
| Green Bank Telescope, WV | 38 25 59 | 79 50 24 |
| | 38 26 08 | 79 49 42 |
| Very Large Array, NM | 34 04 43 | 107 37 04 |
| Owens Valley, CA | 37 13 54 | 118 17 36 |
| Ohio State, OH | 40 15 06 | 83 02 54 |

(ii) In the band 1610.6-1613.8 MHz, within a 50 km radius of the following sites:

| Observatory | Latitude (DMS) | Longitude (DMS) |
|---|---|---|
| Pile Town, NM | 34 18 04 | 108 07 07 |
| Los Alamos, NM | 35 46 30 | 106 14 42 |
| Kitt Peak, AZ | 31 57 22 | 111 36 42 |
| Ft. Davis, TX | 30 38 06 | 103 56 39 |
| N. Liberty, IA | 41 46 17 | 91 34 26 |
| Brewster, WA | 48 07 53 | 119 40 55 |
| Owens Valley, CA | 37 13 54 | 118 16 34 |
| St. Croix, VI | 17 45 31 | 64 35 03 |
| Mauna Kea, HI | 19 48 16 | 155 27 29 |
| Hancock, NH | 42 56 01 | 71 59 12 |

(iii) Out-of-band emissions of a mobile earth station licensed to operate within the 1610.0-1626.5 MHz band shall be attenuated so that the power flux density it produces in the 1610.6-1613.8 MHz band at any radio astronomy site listed in subparagraphs (i) or (ii) shall not exceed the emissions of a mobile earth station operating within the 1610.6-1613.8 MHz band at the edge of the protection zone applicable for that site. As an alternative, a mobile earth station shall not operate during radio astronomy observations within the 1613.8-1615.8 MHz band within 100 km of the radio astronomy sites listed in (i) above, and within 30 km of the sites listed in (ii) above, there being no restriction on a mobile earth station operating within the 1615.8-1626.5 MHz band.

(iv) For airborne mobile earth stations operating in the 1610.0-1626.5 MHz band, the separation distance shall be the larger of the distances specified in subparagraphs (i), (ii) or (iii), as applicable, or the distance, d, as given by the formula:

$$d \text{ (km)} = 4.1 \text{ square root of (h)}$$

where h is the altitude of the aircraft in meters above ground level.

(v) Smaller geographic protection zones may be used in lieu of the areas specified in subparagraphs (i), (ii), (iii), and (iv) of this paragraph if agreed to by the Mobile-Satellite Service licensee and the Electromagnetic Spectrum Management Unit (ESMU), National Science Foundation, Washington, D.C. upon a showing by the Mobile-Satellite Service licensee that the operation of a mobile earth station will not cause harmful interference to a radio astronomy observatory during periods of observation.

(vi) The ESMU shall notify Mobile-Satellite Service space station licensees authorized to operate mobile earth terminals in the 1610.0-1626.5 MHz band of periods of radio astronomy observations. The mobile-satellite systems shall be capable of terminating operations within the frequency bands and protection zones specified in subparagraphs (i)-(iv), as applicable, after the first position fix of the mobile earth terminal either prior to transmission or, based upon its location within the protection zone at the time of initial transmission of the mobile earth terminal. Once the mobile-satellite system determines that a mobile earth terminal is located within an RAS protection zone, the mobile-satellite system shall immediately initiate procedures to relocate the mobile earth terminal operations to a non-RAS frequency.

(vii) A beacon-actuated protection zone may be used in lieu of fixed protection zones in the 1610.6-1613.8 MHz band if a coordination agreement is reached between a mobile-satellite system licensee and the ESMU on the specifics of beacon operations.

(viii) Additional radio astronomy sites, not located within 100 miles of the 100 most populous urbanized areas as defined by the United States Census Bureau at the time, may be afforded similar protection one year after notice to the mobile-satellite system licensees by issuance of a public notice by the Commission.

(2) Mobile-Satellite Service space stations transmitting in the 1613.8-1626.5 MHz band shall take whatever steps necessary to avoid causing harmful interference to the radio astronomy facilities listed in subparagraphs (a)(1)(i)-(ii) of this section during periods of observation.

(3) Mobile-Satellite Service space stations operating in the 2483.5-2500 MHz frequency band shall limit spurious emission levels in the 4990-5000 MHz band so as not to exceed -241 dB(W/m$^2$/Hz) at the surface of the Earth.

(4) The Radioastronomy Service shall avoid scheduling radio astronomy observations during peak MSS/RDSS traffic periods to the greatest extent practicable.

(b) Protection of the radionavigation-satellite service. Mobile earth stations operating in the 1610-1626.5 MHz band shall limit out-of-band emissions in the 1574.397-1576.443 MHz band so as not to exceed an e.i.r.p. density level of -70 dB(W/MHz) averaged over any 20 ms period. The e.i.r.p. of any discrete spurious emission (i.e., bandwidth less than 600 Hz) in the 1574.397-1576.443 MHz band shall not exceed -80 dBW.

(c) Protection of aeronautical radionavigation systems. Mobile-satellite earth stations transmitting in the 1610-1626.5 MHz band shall limit e.i.r.p. levels to no greater than -15 dB (W/4kHz) on frequencies being used by systems operating in accordance with international Radio Regulation RR 732, and to no greater than -3 dB (W/4kHz) on frequencies that are not so being used. Pursuant to international RR 731E and RR 731F, respectively, all mobile-satellite Earth-to-space operations in the 1610-1626.5 MHz band and mobile-satellite space-to-Earth operations in the 1613.8-1626.5 MHz band must be coordinated and notified under the procedures set forth in Resolution 46 (WARC-92). Such mobile-satellite stations shall not cause harmful interference to, or claim protection from, stations in the aeronautical radionavigation service and stations operating pursuant to international RR 732.

(d) Fixed stations operating pursuant to international Radio Regulation RR 730. Pursuant to international Radio Regulations RR 731E and RR 731F, all mobile-satellite operations in the 1610-1626.5 MHz band (Earth-to-space transmissions) and all operations in the 1613.8-1626.5 MHz band (space-to-Earth transmissions), respectively, must be coordinated with systems operating pursuant to international RR 730 according to the coordination and notification procedures set forth in Resolution 46 (WARC-92). All such mobile-satellite stations shall not cause harmful interference to, or claim protection from, stations in the fixed service operating pursuant to international RR 730.

16. A new Section 25.278 is added to read as follows:

**§ 25.278 Additional coordination obligation for non-geostationary and geostationary satellite systems in frequencies allocated to the Fixed-Satellite Service.**

Licensees of non-geostationary satellite systems that use frequency bands allocated to the fixed-satellite service for their feeder link operations shall coordinate their operations with licensees of geostationary fixed-satellite service systems licensed by the Commission for operation in the same frequency bands. Licensees of geostationary fixed-satellite service systems in the frequency bands that are licensed to non-geostationary satellite systems for feeder link operations shall coordinate their operations with the licensees of such non-geostationary satellite systems.

17. A new section 25.279 is added to read as follows:

**§ 25.279 Inter-satellite service.**

(1) Any non-geostationary satellite communicating with other space stations may use frequencies in the inter-satellite service as indicated in § 2.106. This does not preclude the use of other frequencies for such purposes as provided for in several service definitions, e.g., FSS. The technical details of the proposed inter-satellite link shall be provided in accordance with § 25.114(c).

(2) Operating conditions. In order to ensure compatible operations with authorized users in the frequency bands to be utilized for operations in the inter-satellite service, these inter-satellite service systems must operate in accordance with the conditions specified in this section.

(a) Coordination requirements with federal government users.

(i) In frequency bands allocated for use by the inter-satellite service that are also authorized for use by agencies of the federal government, the federal use of frequencies in the inter-satellite service frequency bands is under the regulatory jurisdiction of the National Telecommunications and Information Administration (NTIA).

(ii) The Commission will use its existing procedures to reach agreement with NTIA to achieve compatible operations between federal government users under the jurisdiction of NTIA and inter-satellite service systems through frequency assignment and coordination practice established by NTIA and the Interdepartment Radio Advisory Committee (IRAC). In order to facilitate such frequency assignment and coordination, applicants shall provide the Commission with sufficient information to evaluate electromagnetic compatibility with the federal government users of the spectrum, and any additional information requested by the Commission. As part of the coordination process, applicants shall show that they will not cause interference to authorized federal government users, based upon existing system information provided by the government. The frequency assignment and coordination of the satellite system shall be completed prior to grant of construction authorization.

(b) Coordination among inter-satellite service systems. Applicants for authority to establish inter-satellite service are encouraged to coordinate their proposed frequency usage with existing permittees and licensees in the inter-satellite service whose facilities could be affected by the new proposal in terms of frequency interference or restricted system capacity. All affected applicants, permittees, and licensees, shall at the direction of the Commission, cooperate fully and make every reasonable effort to resolve technical problems and conflicts that may inhibit effective and efficient use of the radio spectrum; however, the permittee or licensee being coordinated with is not obligated to suggest changes or re-engineer an applicant's proposal in cases involving conflicts.

18. The authority citation for Part 94 continues to read as follows:

**AUTHORITY: Secs. 4, 303, 48 Stat., as amended, 1066, 1082; 47 U.S.C. 154, 303, unless otherwise noted.**

19. Section 94.61 is amended by revising paragraph (b)(4) to read as follows:

**§ 94.61 Applicability.**

* * * * *

(b)(4) Frequencies in this band are shared with mobile and radiolocation stations in other services, and must accept harmful interference that may be experienced from operations of industrial, scientific, or medical (ISM) equipment operating on 2450 MHz. In the 2483.5-2500 MHz band, no applications for new stations or modifications to existing stations to increase the number of transmitters will be accepted. Existing licensees as of July 25, 1985, are grandfathered and their operation is co-primary with the Radiodetermination Satellite Service and Mobile-Satellite Service. However, all grandfathered temporary fixed licensees are required to notify directly each Radiodetermination Satellite Service and Mobile-Satellite Service licenses concerning present and proposed locations of operations.